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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue

An Index to the Sixty-seventh Volume of THE RAILWAY GAZETTE, *covering the issues from July 2 to December 31, 1937, is presented as a Supplement to each copy of this week's issue*

Engineers and the Public

THE formation by fourteen leading engineering institutions in Great Britain of an Engineering Public Relations Committee has been announced. Its object is officially stated to be "to present to the public in suitable form information concerning the science and practice of engineering and its services to the public." An inaugural luncheon was held yesterday in London, and this afternoon Professor C. E. Inglis, F.R.S., of Cambridge University, is to give the first of a series of lectures, designed, it is understood, to bring before the public an idea of the work engineers are carrying out for the community. Professor Inglis's first lecture will be on "World-Famous Bridges" and it will be addressed specially to schoolboys. In a letter to *The Times* of December 24 Mr. S. B. Donkin, President of the Institution of Civil Engineers, welcoming the steps that are being taken to consider how best the recently formed School of Planning and Research for National Development can be aided, remarks that the economic side of this question is of vital importance "as no country can afford to incur unwisely heavy expenditure on works which might be designed more economically with the help of expert advice."

The Engineer's Function

From the foregoing it would appear as if engineers themselves might advantageously consider whether their skill and knowledge is being properly directed for the benefit of the community. It may be recalled that the Articles of Association of the Institution of Civil Engineers define the profession of civil engineering as being "the art of directing the great sources of power in Nature for the use and convenience of man." At the present time the great sources of power in nature are in many cases being stemmed back for the very opposite of the use and convenience of man, and with the result that want and insecurity remain unjustifiably prevalent today. The engineer must not shirk his share in the responsibility for this condition of things. He knows how to direct the sources of power in nature, and, if he is to fulfil the purpose of his Charter, he should see to it that they are properly used for the benefit of the community. Apart from the anomaly of restricting production in the face of the shortage suffered by a large proportion of the world's population, the sources of power are at the moment being directed largely towards, not the convenience, but the destruction of man. The position today is indeed a grave one, and the Engineering Public Relations Committee could do no greater service than to draw the attention of the public to the perversion of the science of engineering in the hope that, before it is too late, there may be an awakening to the danger that lies ahead on the road that industrial civilisation is pursuing. It is the engineer's responsibility.

* * * *

The Weeks' Traffics

Except on the L.N.E.R., slight decreases are shown in the traffic returns for the past week, which complete the figures for the year. Aggregates for the fifty-two weeks are: L.M.S.R. £66,210,000, L.N.E.R. £48,552,000, G.W.R. £27,651,000, and Southern £21,649,000; representing aggregate increases of £2,772,000, £2,286,000, £1,317,000, and £731,000 respectively.

	52nd Weeks				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec	
	£	£	£	£	£	%
L.M.S.R. ..	+ 16,000	− 40,000	− 11,000	− 35,000	+ 2,772,000	+ 4·37
L.N.E.R. ..	+ 8,000	− 16,000	+ 12,000	+ 4,000	+ 2,286,000	+ 4·94
G.W.R. ..	+ 1,000	− 23,000	− 19,000	− 41,000	+ 1,317,000	+ 5·00
S.R.	− 4,000	− 3,000	—	− 7,000	+ 731,000	+ 3·49

London Transport receipts for the week ended January 1 (before pooling with the main-line railways) amounted to £541,600 a decrease of £5,600 on the corresponding week last year. The aggregate for the 27 weeks to date amounts to £15,163,700, an increase of £10,300. Great Southern traffics to date show an aggregate decrease of £28,661, Great Northern (I.) an increase of £700, Mersey Railway an increase of £4,515 and Liverpool Overhead an increase of £5,746.

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Mexican Railway Results

The report of the Mexican Railway Co. Ltd. for the half-year ended June 30, 1937, adopted at the general meeting on December 22 as recorded last week, states that political conditions in Mexico remain stable and the general prosperity of the country is reflected in railway receipts which show an increase of 17 per cent. over the corresponding period of the previous year. Expenditure also increased by 12 per cent., and the working ratio was 94·24 per cent. against 98·50 per cent. The number of passengers reached the figure of 1,036,526, the highest since 1930, while the tonnage of goods traffic exceeded all previous records. At the standard rate of 18 pesos to the £ sterling the balance of net receipts amounted to £25,842, which cannot be regarded as satisfactory. Deducting £91,015 for debenture interest and £9,000 for

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British and Mexican income tax, the deficiency for the half-year was £70,633, which increases the total debit of net revenue to £777,772. The figures for the half-year compare with those of the corresponding period of 1936 as follow:—

	1937 Pesos	1936 Pesos
Passenger and express receipts ..	2,034,519	2,022,168
Goods receipts	5,909,909	4,785,538
Gross receipts	8,069,031	6,895,345
Working expenses	7,603,863	6,793,154
Net receipts	465,168	102,191

Increased traffic imposed a strain on the company's equipment and made it necessary to acquire ten first class coaches and 78 freight wagons. As regards the current half-year, receipts have averaged about 44,000 pesos per diem, a very high figure for the company's line, but expenses are unfortunately increasing in proportion. A wage increase recently agreed to will cost about £16,700 a year.

* * * *

Mr. V. A. M. Robertson

London suburban travellers are already more indebted than they may realise to Mr. Vernon Alec Murray Robertson, the successor to Mr. A. R. Cooper as Chief Engineer of the London Passenger Transport Board. Mr. Robertson's work in connection with routes handling intensive traffic began as early as during his pupilage from 1909-12 with Mr. D. Gravell, the railway consulting engineer, when he was engaged on the surveys for the improvement and electrification of the line between Queens Park, and Watford, a section carrying tube trains of the board and L.M.S.R. suburban electric services. The war, in which as recorded in our biographical notice on page 27 Mr. Robertson received decorations for the execution of bridge work under fire, interrupted his subsequent work in the New Works Department of the South Eastern & Chatham system, and soon after demobilisation he became Divisional Engineer, Southern Division, of the former Great Eastern Railway. While with the G.E.R. he was responsible for the engineering work in connection with the introduction of intensive steam services from Liverpool Street. Mr. Robertson was appointed Civil Engineer to the Underground Railways in 1928, and to the L.P.T.B. in 1933, where, under Mr. A. R. Cooper, the important works on which he has been engaged have included the District Line Hammersmith-Northfields widening, and the present Metropolitan line reconstruction between Finchley Road and Harrow.

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The British Railway Stockholders Union

At the fifth annual general meeting of the British Railway Stockholders Union, held in London on December 17, the Chairman, Sir Charles Stuart-Williams, referred briefly to the award of the National Wages Tribunal and to the annual relief on account of local rating. Regarding the present and the immediate future, he said, the companies have participated in the general recovery to a fairly satisfactory degree. The tonnage of heavy traffic showed very considerable improvement over 1932, although the average receipt per ton was about one penny lower. There had been some further improvement during 1937, apart from the increase in rates of about 5 per cent. which came into operation in October. This increase seems to have given rise to some difference of opinion among the members of the union, some holding that the higher rates may handicap the companies in their competition with road transport. As to road competition, the Chairman said the number of licensed vehicles had increased from 1·37 millions in 1932 to 1·97 millions in 1936, and there was no sign of cessation. In this connection special interest attaches to the report of the Transport Advisory Council on the subject of co-ordination. Sir Charles said the proposals of the council contained all the features of a compromise between actively competing agencies, and the real difficulties which attended its execution remained to be faced. Of these the principal one is connected with the road policy of the future. Are we to have a costly system of roads of the *autobahnen* type for a faster type of long-distance vehicle, disregarding the towns and villages, or are we to rely, for heavy transport, on the railways, which already serve those points with a remarkably high factor of efficiency and safety? Finally, on the subject of nationalisation the meeting was referred to the booklet which has been issued by the union.

* * * *

The Cost of Living

The cost of living is a problem of ever-present concern to all workpeople whose incomes depend upon wages, and consequently to all employers. The cost of living index figure at December 1 was 60 per cent. above the pre-war level, and as we reported last week, from Saturday, January 1, a considerable number of railway employees in conciliation grades, are, by operation of the sliding scale agreement, entitled to an increase of one shilling per week cost-of-living bonus. The annual sum involved means, of course, a considerable increase in the wage bill of the companies, and the sum will be even greater by reason of the award of the Railway Staff National Tribunal of August last, under which increases in cost-of-living bonus were extended to all new entrants into railway service since February, 1926. The recent rise in the cost of living was debated in the House of Commons on December 22, when it was suggested that the better organisation of production and distribution and the elimination of "profiteering" would keep the cost of living "within proper limits." While there may be some cases of "profiteering," it is certainly not obvious in any of our great basic industries on which the bulk of our people depend. In reality, production and distribution of goods and services are already so efficiently organised that, except in times of abnormal armament production, industry never has any difficulty in supplying every demand. It is this growing efficiency of industry, with its steadily increasing output per man-hour, that tends to reduce the total of incomes derived from wages. It should, in common sense, be accompanied not by an increase in prices but by a fall.

* * * *

The L.M.S.R. Operating Department in 1937

In the January issue of *On Time*, the journal of the L.M.S.R. Operating Department, Mr. C. R. Byrom has the pleasant task of recording that his forecast twelve months ago of intensive activity in the Coronation year was not only realised, but that the staff of his department rose to the occasion with cheerfulness and energy. The extra effort called for, while reaching its peak at the time of the Coronation ceremony and celebrations, was spread over the whole year. In the first 48 weeks of 1937 the increase in all categories of train-mileage over 1936 amounted to 1·8 per cent. for ordinary passenger trains, 5·6 per cent. for special passenger trains, and 2·8 per cent. for ordinary freight trains. In the mineral department the mileage of booked trains increased by 3·7 per cent., and of special trains by 3 per cent. Although this heavy traffic entailed an increase in engine-mileage for the first 44 weeks of the year of 2·6 per cent., engine casualties were reduced by 11·9 per cent. Such figures may be regarded not only as a tribute to the efficiency of the staff, but also to the efficacy of *On Time* as a medium of information and encouragement.

Adventure in a Railway Tunnel

The difficulty of finding direction when walking through a railway tunnel has formed the subject of a number of letters in recent issues of the *Southern Railway Magazine*. It has now resulted in an interesting account of his own experience some years ago from an anonymous writer. On the occasion in question there had been a sea mist at Weymouth in the morning which had doubtless been drawn into Bincombe tunnel by the trains. The particular trip on which the adventure occurred left Weymouth at 2.10 p.m. with a train of seven bogie coaches well loaded with sailors going on leave. Bincombe tunnel was, of course, built to carry broad-gauge traffic and consequently the walls are too far away to see through the mist. The writer recalls some misgiving concerning the ability of the engine to climb the bank from Weymouth, but all went well as the train left Upwey Junction and entered Bincombe tunnel. When the train was about three parts through, the engine slipped but seemed to recover, and the narrator was soon expecting to see daylight. As the train did not emerge, he went to the window but was unable to penetrate the smoke and darkness. On stepping back he was amazed to see the smoke entering the window from the direction of Weymouth and then saw daylight at the rear of the train and the back coaches running off the road on the catch points at the end of the tunnel. Owing to the slippery state of the rails the engine had been dragged backwards by the weight of the train without the driver being aware of it!

* * * *

A New Steam Crane Design

It has been realised for some time past that, mainly for commercial reasons, jib crane design has not advanced to the standard reached in other modern types of engineering machinery. Considerations of stability have precluded a big saving in the cost of material, any weight saved in the crane structure having to be put back in the form of ballast, whilst the space available to accommodate such ballast is strictly limited. In consequence, the embodiment of modern engineering practice in new designs at once increased the cost of production to a point that limited marketing possibilities. Railway companies are large users of cranes, both fixed and mobile, and those responsible for their operation and maintenance will be interested in the illustrated description appearing on pages 22-23 of this issue, of a new travelling crane adaptable for a wide variety of railway service. The idea of an all-steel, all-welded crane, is one which the builder of this new type has been considering for a number of years, but the difficulty was to offset the cost of welding by savings in other directions. It was realised that if it were possible to make the crane as a two-piece unit—carriage and superstructure—and to cut out all the assembly of parts, there would be a considerable saving in costs. Before this could be done, however, it was necessary to gain experience in the design and technique of welding. With this experience at their command, together with years of experience in crane-building on a large scale, the firm has been able to produce a type conforming with its own ideals.

* * * *

From 4-6-0 to 4-4-0

A tendency of modern locomotive design, more pronounced, perhaps, in America than in Europe, is to reduce, in designs intended for fast passenger work, the number of coupled axles which hitherto has been regarded as essential for the assurance of adequate adhesion. In the United States and Canada, for example, several railways have reverted from the 4-8-4 or 4-8-2 wheel arrangement to the 4-6-4 or 4-6-2 for their principal express passenger trains; for high speed work the 4-4-2 type has reappeared, with its logical development, the 4-4-4 type. In France, lines such as the Etat and the Est, which built large numbers of 4-8-2's, now depend mainly on the 4-6-2 for their fastest trains. In Great Britain a modern instance of this reduction in the number of coupled axles is afforded by the 4-4-0 " Schools " of the Southern Railway, which, as evidenced in the article on page 32 of this issue, are performing between Waterloo, Southampton, and Bournemouth work indistinguishable from that of the 4-6-0 " King Arthurs," though weighing only 67 tons each as compared with the 4-6-0's 81 tons. One of the runs described, with a 485-ton train, is, indeed, a most remarkable example of 4-4-0 locomotive performance.

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171-Ton Engine for 60-lb. Rails

In our issue of November 26 last year we reproduced a perspective photographic illustration of a new 2-10-4 type locomotive fitted with what might be described as a 2-8-2 tender, built in this country for experimental service on the South African Railways. We are now able to reproduce, on pages 16-17 of the present issue, an outlined dimensioned drawing and another photograph of this interesting locomotive, together with details of its design and construction. The engine was introduced for hauling heavy loads over sections of line where 60-lb. rails are laid, and if not actually the heaviest non-articulated locomotive working on that weight of rail, it must surely vie very closely with any other yet put into service in like circumstances. The engine complete and in working order weighs over 171 tons, and is of very large size and power for the 3-ft. 6-in. gauge. It is designed to be capable of traversing curves of 275-ft. radius, the gauge at such points being widened $\frac{3}{4}$ in. We would call our readers' attention to some of the principal particulars of this interesting design, notably the figures relating to the heating surfaces, both distributed and total; the grate area, the size of the cylinders, and the modern equipment. The special wheel arrangement of both engine and tender, and the general characteristics of the design are experiments which must, of course, be well tried out before any question of ordering further locomotives of the same type is likely to be decided upon.

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Special Public Works Number of " The Crown Colonist "

The January, 1938, issue of our associated contemporary, *The Crown Colonist*, takes the form of a Public Works Special Number. A leading article on this subject is followed by a contribution entitled " Public Works in the Colonies," from the pen of Mr. J. W. Spiller, the Chief Engineer to the Crown Agents for the Colonies. In the course of a description of the headquarters organisation in the Crown Agents' office—forming a further article in the number—it is pointed out that the Crown Agents now act as consulting engineers for most of the Colonial railways, and have a large number of inspecting officers stationed in the chief manufacturing centres of the United Kingdom. Under the heading " Colonial Achievement in Public Works " is compiled, colony by colony, a record of outstanding works carried out in recent years or at present in hand. Three great bridges in Africa are illustrated and briefly described, namely the Lower Zambesi, in Nyasaland, the Nigerian Railway Benue bridge, and the Jinja rail and road bridge over the Nile in Kenya. Many important harbour, port and other works closely connected with railways are also dealt with, and there is a short article on " Colonial Road and Railway Costs," based upon a paper read before the Institution of Civil Engineers by Mr. Spiller in 1934.

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Retrospect of 1937

THE year 1937 will long be remembered in transport circles, not only for the Coronation festivities and the vast passenger traffics which they occasioned, but also for the number of noteworthy railway events which occurred. The general improvement in trade and industry, attributable to the marked revival of the iron and steel and coal export trades and the Government's rearmament programme, had a beneficial effect upon railway traffic receipts. These showed an estimated increase of £7,106,000 or 4·53 per cent. over 1936. Of this sum passenger train receipts represented £2,873,000, merchandise and mineral receipts £1,882,000 and coal and coke £2,351,000. Gratifying though these figures are, the companies made it clear when the Railway Rates Tribunal conducted its annual review of railway charges in July that they were being faced with rapidly increasing costs for coal, iron and steel, sleepers, and materials generally. As the companies were unable, in view of the improved industrial situation, to say as in former years that a moderate increase in railway charges would not enable them more nearly to earn their standard revenue, the tribunal ordered that, as from October 1, the standard and exceptional charges of the four main-line companies should be increased by 5 per cent. or thereabouts, subject to certain provisions relating to the application of the increase to low charges, and the exclusion of passenger fares within the L.P.T.B. area. This decision was followed on August 9 by the award of the Railway Staff National Tribunal which restored salaries and wages to the 1930 level by terminating the 1¼ per cent. deduction from earnings, and the variations from standard conditions of conciliation grades, and also slightly increased the wages of the lower paid men.

Coronation year will also be recalled as one during which railway speeds received a greater fillip than in any other year. The streamlined Coronation train introduced in July by the L.N.E.R. is timed to cover the 392·7 miles between King's Cross and Edinburgh in 6 hr. in both directions daily, and establishes a further record by covering the 188 miles from King's Cross to York in 157 minutes, an average speed of 71·9 m.p.h., the fastest run in the British Empire. The L.M.S.R. streamlined Coronation Scot, brought into service on the same date, covers the 401·4 miles between London and Glasgow in 6½ hr. each way and makes the longest non-stop run with steam traction of comparable speed by running between Carlisle and Euston, 299 miles, in 283 min., an average of 63·4 m.p.h. During its trials this train achieved a maximum speed of 113 m.p.h., tieing with the previous L.N.E.R. record. Numerous other acceleration were effected by these lines; and the G.W.R. and Southern companies also improved certain of their timings. The latter company was responsible for probably the most outstanding event of the year—the completion of the main-line electrification between Waterloo and Portsmouth, which enabled express electric services to be run between these points as from July 5. The introduction of the winter train service on September 27 was marked by the most complete timetable re-organisation of recent years—that of the Midland Division of the L.M.S.R. New express services were also introduced between Bradford, Leeds, and London; Sheffield and London; and Norwich, Ipswich, and London, while more than 100 passenger trains were scheduled at start-to-stop speeds of over 60 m.p.h. New express freight train services were put into operation and many accelerations effected. The G.W.R. introduced the first diesel railcar in this country intended for hauling a trailing vehicle, and the L.M.S.R. ordered a number of additional diesel shunting engines.

Many improvements were effected in the design of passenger carriages, and restaurant and buffet cars, and further centre-vestibule carriages were constructed for excursion work. Monthly return tickets at a fare of about 1d. a mile attracted bumper crowds to the railways during the holiday season, and the endless variety of day, half-day, and evening excursions—including in many cases road, river, and sea trips—resulted in remarkably large carryings. Camp coaches again proved so popular that their numbers are being increased for next season; and weekly holiday season tickets made a still wider appeal to holiday makers. The Coronation itself brought millions of people to the Metropolis and provincial cities to witness the decorations and illuminations, while the Royal Naval Review at Spithead also resulted in heavy traffics. Towards the end of the year the first joint railway ticket and parcels office was opened by the four main-line companies at 162, Queen's Road, Bayswater. On the freight train side, the rise in traffics necessitated the acceleration of wagon construction and maintenance programmes, and the placing of orders with outside wagon builders. The stock of road-rail containers was largely augmented, and railhead distribution and country lorry services increased. The registered transit service for passenger and goods train traffic and the C.O.D. arrangements were utilised to a larger extent than in former years and a growing business was done in household removals. A steadily progressing volume of traffic was carried under the agreed-charge principle, over 600 of these charges being put into operation with the approval of the Railway Rates Tribunal during the year. Shock-absorbing wagons were introduced by the L.M.S.R., and partitioned vans by the G.W.R. for the purpose of reducing the oscillation of goods during transit. Closer co-ordination was effected between railway and omnibus interests, and railway interests in road haulage were extended through the medium of Carter Paterson and Pickfords Limited. Railway Air Services continued to build up a network of air routes, which are playing an important part in developing civil aviation in the United Kingdom.

Many improvements were effected in permanent way to facilitate the running of faster and heavier trains, curves being re-aligned and bridges strengthened. Welded rails 180 ft. long, instead of the more usual 60 ft. were laid experimentally by the Southern Railway, and 120 ft. rails direct from the mill on the L.N.E.R. main line. Resignalling schemes were completed at Leeds (New) station and Edinburgh (Princes Street), and colour-light signals introduced at many points. The new Queen's Hotel was opened by the L.M.S.R. at Leeds in November, and good progress was made with the modernisation of the G.W.R. Royal Hotel at Paddington. Several important events also occurred during the year in connection with rail and road transport. The judgment in connection with the Bouts-Tillotson case clarified the position in regard to trunk road services; and in May the Baillie Committee completed its investigation into matters affecting road haulage, recommending the Minister of Transport to take certain steps in connection with the stabilisation of wages, working conditions, and rates within the industry. This was followed in October by the publication of the Transport Advisory Council's report on " Rates and Service " containing a number of important recommendations which, when implemented by legislation, should lead to a greater measure of organisation within the road transport industry, an essential preliminary to serious progress being made towards securing co-ordination with other forms of transport. Add to these events the International Railway Congress at Paris in May and June; the visit of the Institute of Transport to Germany; and the European Timetable Conference at Stockholm, and it will readily be appreciated that 1937 was a year of unusual railway activity.

Centenaries of 1938

OUTSTANDING among the events of 1838 was the Coronation of the youthful Queen Victoria on June 28, and the large numbers of visitors to London for that event doubtless gave the railways their first real experience of handling heavy passenger traffics for exceptional events. The day was marked in railway circles by laying the first stone of the Galgate viaduct on the Lancaster & Preston Railway. Actually, none of the main lines to London was completed at the time, although the London & Birmingham Railway brought into use on April 9 the sections from Tring to Denbigh Hall (16½ miles) and Birmingham to Rugby (29½ miles). By arrangement with the famous coaching firm of Chaplin & Horne a road link was provided between Denbigh Hall and Rugby and so through facilities were made available from London to Birmingham, Liverpool, and Manchester. The rail link over the 34½ miles section between Denbigh Hall and Rugby was opened on September 17 and through services were instituted on that date, making the journey from the Metropolis to either Liverpool or Manchester a matter of under twelve hours. Incidentally, we learn that the completion of this important link may form the subject of centenary celebrations next autumn, for proposals in this connection are now receiving the consideration of the L.M.S.R. authorities. A further opening in connection with the West Coast Route was that of the North Union Railway from Wigan to Preston (15 miles) on October 21 which completed rail communication as far north as Preston, some 218 miles from Euston. Another main line railway company to give substantial indication of its existence was the London & Southampton Railway which was opened from Nine Elms to Woking Common on May 21 and extended to Shapley Heath near Winchfield on September 24. The year 1838 also saw the opening of the first section of 7-ft. gauge line when the G.W.R. brought into service on June 4 about 22½ miles of line from Paddington to Maidenhead Old station (to the east of the Thames bridge). On June 2 the Eton College authorities applied, unsuccessfully, for an injunction to restrain the G.W.R. from taking up or setting down passengers at Slough.

On the Newcastle & Carlisle Railway the missing link of 11 miles between Greenhead and Haydon Bridge was brought into service on June 18—the anniversary of the Battle of Waterloo—and completed the first railway communication from east to west across England. Other openings of the year were Manchester & Bolton on May 29—on which the trains ran on the right-hand road; the Sheffield & Rotherham on October 31; Durham Junction (Washington to Rainton) on August 24 for goods and mineral traffic; Dundee & Arbroath on October 6 from Craigie to Arbroath (14½ miles) on the 5 ft. 6 in. gauge; and the half-mile extension of London & Greenwich Railway from Deptford to Greenwich on December 24. The Durham Junction Railway included the fine viaduct over the River Wear at Penshaw which was named the Victoria bridge in honour of the Queen's coronation. The total mileage opened during the year 1838 thus amounted to about 202 miles which was a considerable advance on the 137 miles brought into service during 1837. In the main these new railways were intended primarily for passenger traffic, in contrast with earlier lines, such as the Stockton & Darlington Railway, which were built mainly for the conveyance of mineral traffic. Thus, although the Grand Junction Railway was opened on July 4, 1837, it was not until 1838 that a start was made with merchandise traffic and even then this was on such a modest scale that the receipts for the second half of the year amounted only to £16,628 as against £161,410 for passengers, so that freight traffic represented in value only 9·3 per cent. of the total receipts. An exception to this was the small Durham Junction Railway which, as already mentioned, was opened for goods and mineral traffic during 1838, but which did not begin to convey passengers until March 9, 1840.

In addition to passengers, mails for the first time began to assume importance as railway traffic during 1838, mainly as the result of the completion of lengthy sections of continuous line between the Metropolis and South Lancashire. At the annual general meeting of the Grand Junction Railway in September, 1837, the directors made a special comment that Liverpool and Manchester had been brought within a night's post of London, "an advantage in which not only the places bordering upon the railway have participated, but others lying considerably wide of, and beyond it; the extent of which accommodation will be best appreciated by the fact that no fewer than 740 mail bags are taken up and set down every day at the several stations on the railway." A few weeks later this co-operation between the Post Office and the railway authorities was further demonstrated by the establishment of a travelling post office, the idea of which was first suggested by Frederick Karstadt, the son of one of the Post Office Surveyors. As an experiment a horse box was fitted up temporarily as a sorting carriage and run between Birmingham and Liverpool, for the first time on January 6, 1838. The experiment was considered so successful that on June 19 of the same year it was decided to make the travelling post office a permanent institution. Accordingly, the first sorting carriage to be constructed specially for that purpose was built by the Grand Junction Railway Company. This vehicle, which was about 16 ft. long, 7 ft. 6 in. wide, and weighed just over four tons, had the further distinction of being equipped with apparatus for exchanging mail bags at speed. The appliance was devised by John Ramsey, an officer of the Missing Letter Branch, who was rewarded for his ingenuity by being appointed Post Office Inspector General. Although improved in 1848 by John Dicker, an Inspector of Mail Coaches, who received a grant of £500 from the Treasury for his ideas, the apparatus designed by Ramsey is substantially that in use at the present time. The completion of the London & Birmingham Railway on September 17, 1838, followed by the North Union Railway from Wigan to Preston on October 21, enabled the London and Preston Travelling Post Office to be established. This still remains one of the main trunk line services, though now extended to Aberdeen and handling a greater quantity of mail than the modest 51 "down" and 44 "up" bags which constituted the make-up of the London-Preston T.P.O. in 1843.

The progress in railway construction in this country was not matched by a corresponding activity in new schemes, for already the first wave of promotion excitement had spent its force. Some 60 Bills were advertised for the Session of 1837-8, but only 26 made their appearance, even by petition, in the House of Commons; and 18 received the Royal Assent. Of the original notices, 28 were for new railway companies, and only two reached the stage of becoming Acts. These were the Edinburgh & Glasgow Railway (incorporated on July 4, 1838); and the Taw Valley Railway (incorporated on June 11, 1838). The former proposed to connect the two principal Scottish cities by a line 46 miles long, and, of course, became an important unit of the North British Railway (now L.N.E.R.), but the Taw Valley was a little local line of 2¼ miles at Barnstaple which had a peculiar career in the gauge war. It was eventually opened as a broad-gauge line on August 1, 1854, after having become the North Devon Railway & Dock Company; was worked for a year

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by the Bristol & Exeter Railway, and finally came into the hands of the London & South Western Railway.

Communication with the Continent was improved during 1838 by the progress of railways in Belgium. On August 28 (a few weeks after the Ghent—Bruges section), the final section, from Bruges to Ostend, of the line from Brussels, was opened with great ceremony in the presence of the King and Queen of the Belgians. As its share in improving communications between Brussels and London, the General Steam Navigation Company immediately placed two steamships, instead of one, in service between London and Ostend (a service which the G.S.N. had inaugurated as early as 1825), and the London—Brussels journey time was reduced to 20 hours. The South Eastern Railway was, of course, not completed between London and Dover until February 7, 1844. Eastward of Brussels and Malines, the Belgian railways reached Ans (near Liége) during 1838. In France the main opening was of the Paris to St. Cloud section of the Versailles Railway, on September 5; considerable interest was taken during the year in the preparations for the Paris—Orleans and Paris—Rouen lines, both opened in May, 1843, and in the progress of the Paris—Dieppe Railway. Railways were making rapid progress in Germany 100 years ago. On September 16 a further portion of the Leipzig—Dresden main line was opened; the first Prussian railway (Berlin—Zehlendorf) was opened on September 22, and completed to Potsdam on October 29; and the first German State Railway (Brunswick—Wolfenbüttel) opened on December 1. Various other sections of line were inaugurated and further railways put in hand. On March 29 the Baden Parliament decided to build a railway from Mannheim to the Swiss frontier at Basle, and this was constructed on the 5 ft. 3 in. gauge, which was retained until April, 1854. An indication of the difficulties of railway promotion during the period of many minor German States is given by the fact that on February 10, 1838, an agreement was made between Baden, Hesse-Darmstadt, Nassau, and the Free City of Frankfort-on-Main, for the construction of the Main—Neckarbahn from Frankfort to Heidelberg, via Darmstadt. In the U.S.A. at the beginning of 1838 there appear to have been some 57 railways completed and in full operation, with a total of over 1,600 route miles; many more lines were in course of construction. One of the American railways which will celebrate its centenary this year is the Norfolk & Western, and an advance notice of the proposed "observance program" has already been issued. The first unit of the present system was the City Point Railroad, a 10-mile line opened from City Point (now Hopewell), Virginia, to Petersburg on September 7, 1838.

A hundred years ago there was a considerable measure of co-operation between the various means of transport, one example of which is provided by the use of road coaches during the early months of 1838 to provide links in both the London & Birmingham and the Newcastle & Carlisle Railways while their lines were yet uncompleted. On the completion of the London & Greenwich Railway, arrangements were made with an omnibus proprietor to convey railway passengers from Greenwich station to Woolwich, Blackheath, and Lewisham. An even more striking "transport co-ordination" was the association of the Great Western Railway with the establishment of the first steamship service across the Atlantic. The idea originated with Isambard Kingdom Brunel who recommended the shareholders of the newly-incorporated G.W.R. in 1835 to "extend their line from Bristol to New York." At first the idea was ridiculed but before very long Brunel found a sufficient number of shareholders who had faith in him to finance a company, known as the Great Western Steamship Company, to build the vessel. She was designed and built by William Patterson of Bristol, and her engines, which were constructed by Maudsley, Sons & Field, were the largest marine engines that had been made up to that date. The vessel, which was 236 ft. in length overall, was launched at Bristol on July 19, 1837, in the presence of some twenty thousand persons and was named *Great Western*. She left Bristol for New York on April 8, 1838, and made the passage in fifteen days. Thus the Great Western Railway, or its shareholders, played a prominent part in the inauguration of what is now so widely known as the Atlantic Ferry. In Belgium, the various openings of new line in 1838 were stated (in September of that year) to have resulted in the withdrawal of 21 diligences in East Flanders, but 54 new ones were introduced in different directions, and no fewer than 23 were arranged to connect with the trains.

In the field of railway journalism of 1838, two of our constituent papers were running at the beginning of the year, namely, *The Railway Magazine*, afterwards *Herapath's Railway Journal* (established May 1, 1835, as a monthly); and *The Railway Times* (established as a weekly Sunday newspaper on October 29, 1837). The latter soon found it unadvisable to attempt mixing the requirements of a specialised trade journal with those of a Sunday newspaper, and beginning with its issue of January 13, 1838, it adopted Saturday as its publishing day and forsook the original page size of about 15 in. × 20 in. for the familiar quarto size. At the beginning of the year, however, it was still a Sunday newspaper which included within its scope such social titbits as the following: "Lord Melbourne is so constant a guest at the Palace that one of two things may be safely inferred—either that Her Majesty has an extraordinary liking for the discussion of state affairs, or if state affairs form not the burden of their high discourse, that the post of Premier is become, through the management of the do-nothing Whigs, one which leaves him who occupies it mightily at his leisure. Liverpool, Castlereagh, and Canning are said to have fallen victims to the cares and fatigues of office; but if Melbourne fall, it will be under a shower of Royal *bon-bons*."

* * * *

Colonel Tyrrell—Soldier Railwayman

THE importance of transportation and of railways in particular, both to the Army and the country generally in times of national emergency, was too well exemplified in the war to require reiteration. Some of our readers will recollect the Special War Transportation Number of THE RAILWAY GAZETTE published on September 21, 1919, which attempted to give an idea of the scope of the transportation effort entailed by large-scale hostilities. At such a time all the railway, dock, and inland water transport resources of the whole Empire, in personnel and material, can be drawn on in the service of the country, but it is important not to lose sight of the preliminary ground work of preparation and organisation, which has to be carried out in peace, if timely use is to be made of our national resources when an emergency arises. Such work normally falls to the professional military railway engineer. In our personal columns will be found particulars of the career of Colonel W. G. Tyrrell, D.S.O., who has recently vacated, on retirement, the appointment of Assistant Director of Transportation at the War Office, the highest military railway appointment in peace time.

Colonel Tyrrell has been directly associated with military railway work for more than half of his service, but his most outstanding achievement was the construction and operation of the Palestine Military Railway. Starting in January, 1916, at Kantara on the Suez Canal with two

Railway Construction Companies of Royal Engineers and a negligible amount of 4 ft. 8½ in. gauge permanent way and rolling stock, Colonel (then Captain) Tyrrell organised the location, construction, and operation of the railway, which ultimately reached Haifa, 400 km. from Kantara, with branches to Beersheba and Jerusalem. By January, 1917, the railway, following closely on the heels of the advancing army, had reached El Arish, 155 km. from the canal. By January, 1919, when the line was completed to Haifa, a total of over 1,000 km. of track had been laid, 86 stations built, and about 5,000 wagons and coaches, and 169 locomotives were in use. The empty desert at Kantara had been transformed into a busy railway terminus with 40 km. of sidings, large and well-equipped workshops—turning out 10 locomotives a month from heavy repairs—electric generating plant, and all the requirements for the operation and maintenance of a railway from London to Plymouth.

During times of pressure track was laid at the rate of 1¼ miles a day, and this had to be done in the early morning and late afternoon owing to the excessive heat in the middle of the day; the location, earthwork, and bridge construction parties kept well ahead of the track-laying. Whilst the railway was being built and was carrying men and materials for its own construction, it had also to transport men, rations, ammunition, and in the early stages water also for the troops in advance. As the railway proceeded, locomotive water stations were provided about every 40 km. by the construction of reservoirs which were fed by a pipe line from the fresh water canal at Kantara; and the railway, which started as a single line, was subsequently doubled as far as Rafa (200 km.) in 1917-18. The operation of the line in the efficient manner necessary for the rapid advance of the Army was rendered possible by the introduction of a sound system of telephonic train, rolling stock, and personnel control. The organisation of all this construction, maintenance, and operating work called for unusual ability, and it is significant that, starting with only about 500 Royal Engineers, Colonel Tyrrell ultimately had at the peak of construction as many as 97 officers, 6,000 other ranks of the R.E.'s, and 26,000 native labourers under his control. In fact, the successful manner in which the railway was built and its efficient operation under very difficult conditions are lasting records of his energy and skill. Finally it may be said that throughout his career Colonel Tyrrell's aim has always been to acquire as much knowledge of railway construction and operation as possible to apply this to the needs of the Army in its simplest and most effective manner, and to pass on this knowledge to others in the best possible way. There can be no doubt that he has been particularly successful in teaching others, and in the planning, carrying out, and administering of transportation projects.

LETTERS TO THE EDITOR

(*The Editor is not responsible for the opinions of correspondents*)

Main-Line Electrification

99, Clifton Road, S.E.25,
December 27

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—In your issue for December 17, the Secretary of the Railway Stockholders Union taxes me with what he describes as utter confusion. Perhaps I may point out that the table of working costs on the Southern Railway, and the excerpt from Philip Burtt's book (expressing faith in electrification even for a branch line conveying, as he suggests, probably not more than half a dozen steam-hauled trains a day) were quoted irrespective of my own views, primarily for the purpose of refuting statements made by Mr. Ashley Brown.

But where, in any case, would be the inconsistency in advocating a measure of partial electrification under intensified traffic conditions—certain in itself to yield anything from 12 to 20 per cent. on the additional capital outlay—as a means of testing in practice and on a really adequate scale the unexplored possibilities of electrification in general? That extensions would follow there is little doubt, just as the results achieved by electric traction between New York and Washington have led to the recent extension as far as Harrisburg; and just as the introduction, under pressure from Newcastle business men, of the Silver Jubilee express has resulted, after years of needless delay, in similar services to other leading towns.

Indeed, one of the most valuable features of the proposals is that the railways would thereby be enabled to feel their way without the slightest element of risk. As Mr. A. D. Lindsay asserts in his book, "The Essentials of Democracy":—

> In the alternation in power of political parties there is often worked out in practical dialectic what discussion could not discover.

On the railways, unfortunately, it would appear that practical dialectic has too often in the past been stifled by arbitrary control. On at least one of our main-line groups, for example, the introduction of roller bearings was held up for many years for considerations of safety. Whereas a little mature reflection would probably have suggested the existence of many vehicles, such as parcels vans, whereon these bearings could have been tried out with an absolute minimum of risk, safeguarded as they might have been by loose-running bearings of the normal type ready to take the load in case of emergencies. Again, on pp. 123 and 124 of Mr. Newlands's book, "The British Railways," there is a most interesting enumeration of the serious losses due to having wheels and axles keyed to each other on both sides. But apparently no steps are being taken, experimental or otherwise, towards the emancipation of wheels—so far, at least, as our own railways are concerned.

It is interesting to contrast such an attitude with that of a pioneer like George Stephenson, as illustrated in the following letter to *The Times* appearing on April 4, 1912:—

> Between 1845 and 1850, I was junior partner in the Glass Manufacturing firm of Newcastle and South Shields of R. W. Swinburne & Co. (G. Hudson and R. Stephenson were also partners).
>
> G. Stephenson used to come and see us, and was very kind to me as a young man.
>
> In 1847 he explained to me that several of our operations were the results or effects of electricity, and then proceeded to give me quite a lecture on the subject. There was very little use for electricity at this period. He also explained to me that several phenomena of human daily life were electrical, and said finally: "I have the credit of being the inventor of the locomotive, and it is true I have done something to improve the action of steam for that purpose. But I tell you, young man, I shall not live to see it, but you may, when electricity will be the great motive power of the world."
>
> These words impressed me much then, and much more now that I have lived to see the near fulfilment of his prophecy.

Granted an equal openness of mind, our present railway administrators might well discover what has long been recognised in America, that even long-distance traffic like that between New York and Washington rapidly becomes outer suburban in character if provided for as such.

In view of the recent plea in your columns for A.T.C., it may be not inopportune to point also to the very attractive possibility that would arise on lines so densely worked of installing the much more effective system of cab-signalling whereby electrified sections of the Pennsylvania Railroad have been rendered proof against accident and fog.

To sum up, I had hoped the suggested policy of traffic concentration would meet Mr. Ashley Brown's requirements

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regarding the need for a heavy load if electrification is to pay. In his continued leaning towards infrequent steam-hauled expresses for main-line work, he seems hardly to bear out that desire merely to preserve the balance of public opinion to which he lays claim at the end of his second letter: just as his earlier communication appeared to go far beyond being a mere protest against the electrification of the railways *en bloc*, such as he now claims it to have been.

Even if the table of comparative working costs be amended as he suggests by the inclusion of some 7,000,000 goods shunting-miles on the same basis as train-miles, the saving shown by electric traction over steam will only be reduced from 11d. to 7d. per train-mile, leaving the annual net saving still as high as £870,000 a year.

On re-examination of Mr. Ashley Brown's book, however, I find I have inadvertently misrepresented him on the question of suburban electrification. In one of the chapters, there is a prophecy to the effect that the example of the Southern Railway is unlikely to be followed as regards the outer suburbs, which I had at first interpreted as an allusion to suburban areas in the provinces. I now see it had reference to long-distance residential centres like Brighton and Eastbourne, and I offer this explanation with my apologies and regrets.

Yours faithfully,

K. H. JOHNSTON

King's Cross and Yorkshire

56, St. Mary's Mansions, N.W.2,
December 27

To the Editor of The Railway Gazette

Sir,—The letter from "Vitesse" published in your issue of December 24 raises some very interesting possibilities, and although I am rather sorry that "new high-speed trains" figure so largely in the suggested re-arrangement (for there must be a limit, in this respect, to the capacity of the old Great Northern main-line, and "new streamlined trains" ought not to be suggested as the solution of every difficulty) many of his proposals will be heartily endorsed by regular travellers. But in all future re-castings of the London and Yorkshire services the Marylebone, St. Pancras, and King's Cross facilities ought undoubtedly to be pooled, as was clearly indicated in your articles on the Midland accelerations last October.

The suggested 8.30 a.m. from King's Cross has already been advocated in your columns, but surely it should leave at about 8 a.m. (so as to give time for business before lunch in the Yorkshire towns) and serve also Sheffield and Grimsby, by a stop at Retford. The suggested return is practically a restoration of the pre-war facilities—once an independent train from Bradford, balancing the 2.15 from King's Cross, and afterwards at 6.30 from Leeds to Doncaster connecting with the afternoon Edinburgh train—which duplicated (from Leeds) the service then given by the 1.30 from Glasgow to St. Pancras. This might, indeed, be an excellent way of using the Yorkshire Pullman—provided its supplement does not exceed that of the West Riding and the speed justifies an extra fare—for the present working of the Pullman is ill-balanced and will tend to clash, next summer, with the Scarborough Flyer from York.

But, rather than institute a new "high-speed" 4.45 from King's Cross, I should have ventured to suggest a regular duplication of the present 4.0 p.m., the running of the West Riding 7.10 as close as possible to the 5.30 Silver Jubilee, and a later departure and acceleration of the 5.50. I cannot see the necessity for a new high-speed service from Hull, Sheffield, &c., passing the 10.10 from Leeds at Peterborough (a most undesirable plan for operating reasons), as I believe that the present 1.3, 1.15, and 1.47 King's Cross arrivals could, between them, do all that is necessary, and there must, of course, be grave objections to any division of the West Riding Limited. And what about the possibility of a real Sheffield Limited to and from Marylebone, with Halifax and Huddersfield connections (as was suggested in your columns on November 27, 1936), which would have been a far more useful service, generally, than the Midland's Sheffield and St. Pancras non-stop?

Yours, &c.,

R. E. CHARLEWOOD

All-Steel Coaches

London, January 3

To the Editor of The Railway Gazette

Sir,—It is seldom that anyone confounds his own argument so effectively and fully as does Mr. P. Henderson in his letter in your December 31 issue, for in querying the desirability of steel cars he says "If all-steel coaches had been used [at Castlecarry], would not the number of persons injured have been increased by more than the number of people who were killed in the accident?"

The answer is Yes.

Would not Mr. Henderson prefer to be injured on several occasions rather than killed—once?

I am, Sir,
Yours faithfully,

KENNETH CANTLIE

"The Railway Times"

London, December 20

To the Editor of The Railway Gazette

Sir,—An interesting point in the history of your oldest weekly constituent, *The Railway Times*, the centenary of which you noted in The Railway Gazette for October 29 last, is that it was founded by John Braithwaite (1797-1870), the celebrated engineer of the Eastern Counties Railway from its formation up till May, 1843. Mr. Braithwaite was the sole proprietor of *The Railway Times* from 1837 to 1845, and his first editor was Mr. J. C. Robertson. The works of the Braithwaite family in New Road, London, became Braithwaite & Milner in the early 'thirties. John Braithwaite gave up active interest in the business in 1834 or 1835, and when locomotives were built for the Eastern Counties Railway it was his brother, Frederick, who was at the head of the firm.

Yours faithfully,

BRIAN REED

[Brief reference to two of our early constituents is made on page 6 in the course of an editorial article on "Centenaries of 1938." The facts stated above by our correspondent account for the "pro-Eastern-Counties" attitude of *The Railway Times* in its early years. On the other hand, John Herapath of *The Railway Magazine*, who had resigned from the provisional committee of the Eastern Counties Railway, was a keen critic of the policy of that company. Hence, at one time, feeling ran high between the two journals.—Ed. *R.G.*]

Speedometers on the G.W.R.

Westinghouse Electric and Manufacturing Co.,
20, North Wacker Drive, Chicago, Ill.
December 14

To the Editor of The Railway Gazette

Sir,—As one of your subscribers I am interested in your comment on page 996 of the December 3 issue on the G.W.R. locomotive speedometers. Could you enlarge on the "experience" that led to the decision to equip additional engines with speedometers? Why does the installation of a total of 250 units prove to be a good investment?

Yours very truly,

CORLISS A. BERCAW,
Transportation Division

[We understand that the equipment of speedometers has enabled the G.W.R. to reduce the margin required for safety when fixing speed restrictions, which is of course a good investment, and that it is the intention of the company to equip all its main-line locomotives with speedometers.—Ed., *R.G.*]

Christmas and New Year's Greetings.—Acknowledgement for Christmas and New Year greetings and tokens, received after compilation of the list published last week, is due to the following:—

Mr. D. S. Barrie; Flowerdew & Co. Ltd.; Mr. Edward Hungerford; the Institute of Fuel; the General Manager, New Zealand Government Railways; Pennsylvania Railroad; Mr. W. J. Reynolds; Mr. A. M. H. Solomon; The Docks and Marine Manager and Staff, Southern Railway; Mr. W. W. Stewart, Mr. Mervyn Talbot.

PUBLICATIONS RECEIVED

Alfred Krupp. By Wilhelm Berdrow. Berlin, 1937: Verlag für Sozialpolitik, Wirtschaft und Statistik Paul Schmidt. 8¼ in. × 5 in. 326 pp. Price 6 RM.—There is something dramatic in the word "steel" that has inspired many familiar idioms of common speech. The ordinary man who talks of "steeling" himself for an ordeal, links the words unreflectingly, just as to the name Krupp he would respond "of Essen" as an involuntary echo. But "Krupp of Essen" is a phrase of more than industrial significance. This book gives it the importance of a phase in German history. It shows how the rise of the firm and the welding together of the separate States into the German Empire were parallel and interwoven processes. The customs union of 1834 opened the way to an extended sphere of enterprise which was the prelude to Krupp becoming an international name. In 1870 Krupp cannon, wreathed with the garlands of victory, passed through the Brandenburger Gate into Berlin in triumphal procession behind the first Emperor of a united Germany.

The greater part of this book is the biography of Alfred Krupp, who in 1826, at the age of 14, inherited the management of the steelworks founded at Essen by his father, Friedrich Krupp, in 1811; and laboured continually for the reputation of the enterprise that bears his name until his death in 1887. Alfred Krupp came under the spell of steel in his earliest years. He was only 7 when his father celebrated the first melting in the new foundry by gathering his workmen and sons around a huge bonfire of burning coke, where they sang patriotic songs while casting went on in the shop. From such recollections of semi-religious fervour Alfred must have derived that ardent dedication of his energies to the cause of steel that enabled him to overcome his constant burden of indifferent health; and to travel hundreds of miles by coach over the roughest roads, snatching what sleep he might as he journeyed, so that he could extend the radius of his calls to reach customers throughout Europe.

A knowledge of the early struggles of Alfred Krupp as recounted in this book is necessary to the full appraisement of his later work. It seemed at first as if not only the circumstances of insufficient funds and inadequate machinery were against him, but Nature herself. A dry summer and a severe winter robbed of its power the waterwheel with which he drove the machines in the first workshop, where he turned, ground, and polished his hardened steel rolls. When there was water, it had to be used for forging; and when there was none, all work stood still. After a year he removed his lathes to the foundry, where they had to be turned by hand. It was the urgency of acquiring a steam engine for his workshop that first sent Alfred Krupp on his long, arduous, but ultimately successful journeys in search of new business—journeys that now brought him for the first time to England.

Disappointment faced him on his first excursion into that field with which, perhaps, his name is linked more than by any other in the popular mind. Krupp's earliest essay as an armourer was in the supply of steel cuirasses to the Prussian troops. His plates amply proved their resistance to bullets, but other and older firms carried off the order by reason of their superior equipment for finishing the steel. He had, however, set his foot upon the path that was to lead him to the status of a national hero. In a few years he was to hear of the Prussian Guards before Paris welcoming his guns with shouts of joy, caressing them as they pressed round them on the march, and encouraging them as if they were living creatures. His dogged competition against old-established firms in his own and other countries had been rewarded.

It was the same when he tried to extend his business from the production of tools, cutlery, and dies for minting coins, to the heavy machinery field. But here the new claims of steam traction helped to weaken official conservatism. Orders for springs, axles, and other steel parts began to come in from German, French, and Spanish railway companies. In 1852 he first cast steel tyres for railway vehicles, rolled in one piece and so without the weakness of a welded seam. The first locomotive of the Semmering Railway in Austria ran its trial trips on Krupp tyres. At the same time, the Austrian Lloyd and the Danube Steamship Companies were among those adopting Krupp cast steel for shafts. It was in this peaceful traffic, rather than in the supply of war materials, that Alfred Krupp at that time saw the brightest hopes for the future of his enterprise.

As the fortunes of a pioneer must, the fortunes of Alfred Krupp fluctuated. But always he was sustained by that faith in his work which has caused the author of this book fitly to designate him "the prophet of steel." Even in his last journey there was the solemn grandeur of a prophet's passing. In the light of torches, his coffin was carried to the grave through black-draped streets lined by 12,000 workmen. The story of the huge family of craftsmen that Alfred Krupp gathered round him is a romance of its own, with its own heroes. The Krupp workpeople, like the Krupp enterprises, were undeflected by adverse circumstance. At a time of industrial unrest, the foreman at Krupps led his men to work through hostile crowds, armed with a knobbed stick. The descendants of that little band, years later, carried on the Krupp tradition through the troubled years of the German Republic, and in the period of post-war reconstruction helped in extending the achievements of their firm into new fields. Locomotive building was taken up, and from the production of the first engine in December, 1919, until the end of 1935, more than 1,500 were supplied—about a third of them to other countries. The closing chapters of the book, tracing the history of the works at Essen after Alfred Krupp's death, show that Krupps of Essen plays as important a part in the national life today as it did in the formative years of the modern German people.

To conclude with a minor criticism, regret will surely be felt at the lack of an index to this detailed chronicle of the Krupp family for 150 years—from the birth of the founder of the firm in 1837 to the present day.

Spirit of Progress.—The time has come when new luxury express trains show sufficient departure from conventional standards of seating and accommodation to warrant the publication of descriptive booklets somewhat on the lines of hotel tariffs. A handsome venture in this direction, announcing the new Spirit of Progress streamlined train of the Victorian Government Railways, has been sent to us by Mr. Harold W. Clapp, Chairman of that administration. The Spirit of Progress—described in our Special Overseas Number of November 24, 1937—runs non-stop between Melbourne and Albury (190½ miles), connecting with the Sydney express service of the New South Wales Government Railways. Every car in the Spirit of Progress is air-conditioned, giving (to quote the booklet) "an atmosphere agreeably cosy in winter, and with a springlike freshness in summer." Silent running and absence of vibration are other attractive travel features emphasised in a page of persuasive introductory description. But perhaps what must first strike the traveller in this train is the interior decoration and furnishing, shown in the booklet in a series of large coloured views accompanied by seating plans. Ordinary coaches are of the compartment type, with leather upholstery, armrests, and strip lighting under the luggage racks. At the rear is a round-ended parlour observation car with armchair and settee seating, and—as a final domestic touch—bookshelves and standard lamps. The train is shown at speed in a double-page coloured view in the centre of the booklet.

On page 28 we reproduce a striking poster illustrating this fine train, and on page 11 will be found an Overseas paragraph on the schedule to which it runs.

Small Tools.—The range of small tools for engineers manufactured by A. A. Jones & Shipman Limited, East Park Road, Leicester, is described and illustrated in a new catalogue published by the firm. This is a well-produced publication in stiff covers—with a copious four-page index—that will withstand the frequent consultation of its contents likely to be made by engineering users. In addition to the many accessories such as cutters, grinding wheels, tool-holders, clamps, vices, and complete lathe tool sets which are listed, the catalogue describes small electric tapping machines and portable drills.

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THE SCRAP HEAP

Traveller: "What's the use of having a timetable if your trains don't run to it?"

Porter: "Now you're all excited. How could you tell they was runnin' late if you didn't have a timetable?"

* * *

The hip bone of a mammoth was found recently by men at work on the new Berlin Nord-Sud underground railway, 70 feet under Potsdammerstrasse. The find was taken to the Märkische Museum, where experts estimated the bone was some 35,000 years old.

* * *

Mr. V. A. M. Robertson, the new Chief Engineer of London Transport (see pages 2 and 27) has been keenly interested in sport. At Dover College he won his colours for football, and while studying at the Crystal Palace School of Practical Engineering he was secretary of the Rugby Football Club and played occasionally for Middlesex. The highlight of his sporting career was to bowl W. G. Grace in a match between the students and a side captained by Grace.

* * *

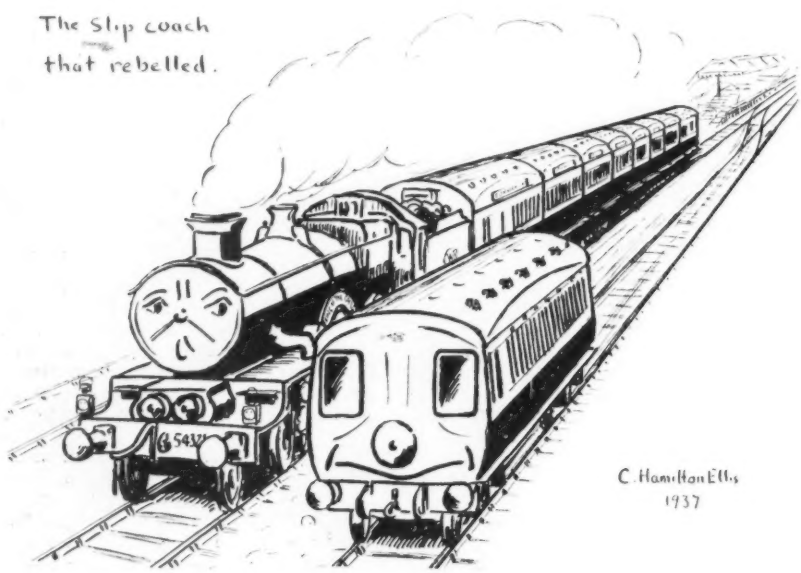
A locomotive superintendent of one of our railways tells of an occasion when he visited in his managerial capacity, after a lapse of years, the railway workshop where he was apprenticed as a youth. He arrived and found all the workmen assiduously employed—in fact suspiciously so—and on completing his round, he had a word with a young apprentice near the doorway. "Is it you, my lad," he asked, "who has to keep a look out and bang the girder with a spanner when one of the bosses is comung?" The lad coloured up guiltily and looked embarrassed. "Oh, you needn't mind my asking," said the superintendent reassuringly. "That used to be my job thirty years ago."—*From "The Best Railway Stories," published by the Richards Press Limited.*

* * *

London Transport escalators become more popular every week. A special census just made shows that since escalators took the place of steps between the Northern City Line and the Northern Line at Moorgate, the interchange traffic has increased from 1,300,000 to 1,718,000 a year. When improvements at Moorgate have been completed, the traffic is expected to increase to 2,000,000 a year. In addition to 10 escalators now in hand, plans are being prepared for 36 more, bringing the number to 189. The total length then will be more than three miles.

* * *

So universal is the habit of converting every edifice into an advertising space, that railway companies deface their architectural features with bills and boards. Wherever there is a railway bridge or arch it is at once used so as to give the utmost air of squalid untidiness to its entire district. On the railway bridge at Blackfriars they have allowed huge bills to be placed. In the State of New York there is a law against defacing public edifices; but in our metropolis perfect immunity is allowed to anyone who, for the sake of a few pounds or shillings per annum, may choose to mar the effect of all that has been accomplished.—*From "The Times" of July 18, 1872.*



An artist's dream of a slip coach that "took the wrong turning"

This Merry Christmas

TRY THE TRAIN

All sixty thousand of us say
We hope your happy holiday
Begins and ends with one refrain:
"This Merry Christmas,
TRY THE TRAIN!"

LOW WINTER FARES are in effect, trains and cars are polished up, and sixty thousand S. P. employees are ready to give you a smooth, safe, swift trip over the Holidays. Don't forget: trains are SAFE in any weather, cars are steam-heated, restrooms are convenient. THIS TIME, TRY THE TRAIN.

GIVE A TRIP. Why not give a Southern Pacific trip to a relative or a friend this Christmas? It's easy. Send one to anyone, anywhere. Ask about our Prepaid Order service.

Southern Pacific

Seasonable advertising by the Southern Pacific Lines, U.S.A.

* * *

In March, 1861, the London & North Western Railway Company issued instructions to the effect that every officer and servant (including engine-drivers) throughout its system "shall in future have one-half of the Sunday free, so as to give them the opportunity, if they should so think fit, of attending divine service either at the company's own churches at Wolverton and Crewe, or elsewhere."

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

SOUTH AUSTRALIA

Three Gauges at Port Pirie Junction

Port Pirie, on the eastern shores of Spencer's Gulf, is South Australia's largest provincial city and seaport, and has so far been famous chiefly for its great smelting works, the largest of their kind in the world for the treatment of crude ores. These are railed direct from Broken Hill *via* Peterborough over a 3 ft. 6 in. gauge line. Since July 23, however, Port Pirie has acquired additional importance, in that it is now the eastern terminal of the Commonwealth Railway's 4 ft. 8½ in. gauge Transcontinental line from Kalgoorlie in Western Australia, because, on that date, the Port Augusta—Port Pirie extension of this line was opened, as recorded in THE RAILWAY GAZETTE of July 30 and September 10. It is, moreover, the interchange station between the 4 ft. 8½ in. gauge and the 5 ft. 3 in. South Australian system by virtue of the opening, on the same date, of the Redhill—Port Pirie extension of the line from Adelaide. There are thus three gauges at this important centre, including the old 3 ft. 6 in. South Australian lines, a feature which is unique, at any rate, in Australia.

The point at which all three gauges meet is Port Pirie junction, where a modern island platform structure and layout have taken the place of the old 3 ft. 6 in. gauge wayside station known as Solomontown. The junction is connected with the city station in Ellen Street by extensive yards a mile in length, but the 4 ft. 8½ in. gauge does not run into the Ellen Street station. The yards have been considerably enlarged to accommodate the Transcontinental traffic, and there is important concentration of freight working here, not only mineral traffic from Broken Hill, but also miscellaneous freight from the central and northern areas of the State, which comes to the seabord at Port Pirie. [*See* illustrations on page 24.—ED. *R.G.*]

Train Services and Rolling Stock

The passenger train service on the S.A.R. side consists of morning and evening trains in each direction between Adelaide and Port Pirie, and it is the evening train from Adelaide that becomes the Perth express, *via* the Transcontinental route, three times weekly. On the other, alternate, days a local stopping train between Port Pirie and Port Augusta connects with the Adelaide service. Electric staff working is in force both between Salisbury and Port Pirie (S.A.R.), and between Port Pirie and Stirling, near Port Augusta (C.R.).

A remarkable assortment of locomotives is to be seen at Port Pirie junction. There are S.A.R. "600" class Pacifics, and "620" class semi-streamlined 4-6-2s, "T" class 4-8-0 goods engines on the ore trains from the New South Wales border; also the "G" and "Ga" (superheated) type Commonwealth 4-6-0's, and "Y" class 2-6-0 narrow-gauge shunting engines, in addition to "S" class 4-4-0, and "Rx" class older 4-6-0 broad gauge locomotives, all intermingled. The new S.A.R. light-green all-steel passenger stock contrasts with the brown Transcontinental coaches and the small 3 ft. 6 in. gauge coaching stock.

VICTORIA

Further Details of the Accelerated Sydney Limited

[In our issue of December 17 we were able to give brief details of the new schedules of the Melbourne-Albury, or Sydney Limited expresses in each direction, but have now received the following fuller information of these tightly-timed trains from a Victorian correspondent.—ED., *R.G.*] The 30-min. acceleration of these trains came into force on September 27, in anticipation of the early completion of the new air-conditioned semi-streamlined stock for this service. The provision of a 13,000-gallon welded tender has enabled the stop for water at Seymour to be eliminated; the loaded weight of this 12-wheel vehicle is 106½ tons.

The first 68¼ miles out of Melbourne to Mangalore are double line, but the remaining 122 miles to Albury are single, and worked with miniature electric staff. Staff-changing is effected with automatic apparatus at speeds up to 60 m.p.h. Heavier switches and crossings and modifications in yard layouts have enabled speed limits through stations to be increased—with certain exceptions—to 60 m.p.h. Curves of 40-ch. radius and over have been relaid and strengthened to allow of the maximum permissible speed throughout the run, 70 m.p.h. On both sides of the 1,145-ft. altitude Continental Divide, the summit of which is at Heathcote junction (mile 33), 1 in 50 is the ruling gradient, and on the single-line section there are no fewer than 14 slacks for staff exchanging, including one to 20 m.p.h.; through Seymour there is also a long 25-mile speed restriction.

Speed Recorders Invaluable

To ensure observance of these restrictions all Victorian locomotives, other than shunting engines, are fitted with Flaman speed recorders, type E3, the graphs of which are frequently checked by responsible officers. It is remarkable that the average speed works out at 75·75 per cent. of the maximum permissible speed in the southbound, and 70·86 per cent. in the northbound direction for these runs, and, seeing that the load behind the tender (itself some 50 tons heavier than usual)—though liable to vary from 330 to 525 tons—averages 480 tons, it will be appreciated that a very high standard of locomotive performance has to be maintained over this difficult road. The three-cylinder "S" class non-streamlined Pacifics have been able to keep time without difficulty [on page 21 one of these fine engines is illustrated at the head of the southbound train. *See* also pages 9 and 28.—ED. *R.G.*].

CEYLON

Railway Reorganisation

The railway reorganisation scheme includes a 48-hr. week for running and other staff, and overtime is now paid only for work beyond this period. This and other reforms appear to be causing considerable unrest in all departments. Wages and salaries generally have, however, not been reduced, though a commission is to be appointed to consider the Hammond recommendations in this connection.

Reduction of Non-Ceylonese Staff

Possibilities of retrenchment in every branch of the railway have been carefully investigated, and a programme for reduction of staff, including daily paid hands, has been drawn up. A drastic reduction is to be made of non-Ceylonese employed on the railway. Of 29 Chinese employed in the Way and Works Branch, nine are to be discharged immediately. Of 200 firemen and special apprentices whose services can be dispensed with at an early date, 125 are non-Ceylonese. The latter are to be given a month's notice immediately and discharged from service, a gratuity being paid to each of them under the Pensions Minute. All other firemen who are over 50 years of age and whose medical record is unsatisfactory, are to be examined by medical boards as to their fitness for further service. The remaining surplus firemen are to be absorbed by other departments of the railway or by other Government departments.

Training for Probationers in England

It is proposed that suitable young Ceylonese with honours degrees—two to begin with—should be recruited as probationers for posts of assistant transportation superintendents in the Government Railway and sent to England for railway training. Enquiries are also to be made from the Crown Agents in London in view of the proposal to recruit two European assistant transportation superintendents.

Another Economy Measure

Railway passengers were somewhat surprised when a batch of young men in plain clothes asked for their tickets at the station exits one day this week. The only identification marks these new ticket examiners had about them were a card of authority from the General Manager of Railways and a

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badge in the shape of a flag bearing the letters "T T E." The card of authority they carried in their pockets, while the badge was hidden behind the lapels of their coats. These young men, it is understood, were taken from the railway clerical staff and put under a course of training before they were appointed travelling ticket examiners. This latest step is intended as an economy measure in filling vacancies from departments where the number of clerks is considered to be superfluous.

INDIA

Cost of Coal on S.I.R.

In view of the demand for cheaper railway fares, that is often voiced in the press and in the Legislatures, a press note issued by the South Indian Railway gives the comparative costs of coal on various Indian railways and shows that the third class fares on the S.I.R. compare very favourably with those of other railways better situated as regards fuel expenses. In 1936-37, the average cost of coal on this railway was Rs. 17·34 a ton, which is Rs. 5 a ton more than on the Madras & Southern Mahratta Railway, and much more than on the Eastern Bengal, East Indian, Nizam's State, and Bengal-Nagpur Railways. The additional cost of coal to the South Indian Railway is due entirely to the long haulage involved from the coalfields. It is pointed out that the railways are, at present faced with an increase in the price of coal and other stores and materials, a factor which may make it necessary to consider an increase, rather than a decrease, in fares.

Cochin Harbour Extension

An estimate, amounting to Rs. 13·65 lakhs has been sanctioned by the Cochin Government, the Railway Board, and the home board of the South Indian Railway for the extension of the Shoranur-Cochin State Railway to link up with the Cochin Harbour Railway, programmed for construction by the harbour authorities under the fourth stage works of the harbour scheme. This link will take off from a point between Idapalli and Ernakulam stations, about one mile north of the existing Ernakulam station. The total length of the proposed extension is about 4 miles.

Evidence of the growing popularity of the port of Cochin is to be found in the recent disembarkation of a large number of passengers from the Bibby liner *Derbyshire*, at that port. No fewer than 63 first class passengers travelled by the Cochin express on that occasion to Madras Central and other stations.

Economy Research

In accordance with the recommendations of the Wedgwood Committee, the South Indian Railway administration proposes to undertake detailed investigations into the present methods of operation with a view to effect improvements and to realise economies, wherever possible. In the first place, Rao Sahib M. Ramchandra Iyer, Senior Assistant Auditor, has been appointed as Organisation Officer of the Audit Department, to review the work of that department.

Station Remodelling

Pollachi station was originally the terminus of the Podanur-Pollachi branch of the South Indian Railway. Following the opening of the Dindigul-Pollachi line and of the metre gauge extension to Olavakkot junction, the station has become a busy three-way junction which needs remodelling in order to deal expeditiously with the increased traffic. The work has received the sanction of the authorities and will be taken in hand early in the New Year.

GERMANY

Improved Position of Bavarian Light Railways

The Bavarian light railway undertaking, Lokalbahn A.G., a brief account of which appeared in THE RAILWAY GAZETTE for May 7, 1937, was able in 1936, for the first time since the reorganisation consequent on the national transport co-ordination policy, to show an improved result. Tonne km. of freight rose from 6·37 to 7·47 millions, with receipts totalling 1,470,800 RM. against 1,283,600 RM. the year before. Passengers carried rose from 4·49 to 5·04 millions, receipts being 1,665,400 RM. against 1,572,500 RM.; road competition has however, further increased. The operating coefficient was 86·8 against 88·7 in 1935. Of the total length of line now being worked, about 185 km. (115 miles) only one third is actually profit bearing.

The Isar Valley Section

In 1936 the Isar Valley section showed an operating loss of 280,000 RM. It is unlikely this position can much improve, but the deficit bearing section cannot be closed. The company is unfortunately faced with rather heavier interest and other charges than most concerns of its kind, although the rates of payment are not greater than usual. When the company was in difficulties the staff assisted by accepting much lower wages, but normal rates were restored on July 1, 1937. A net profit was made in 1936 of 36,005 RM.; inclusive of a sum brought forward, after setting aside 20,000 RM. to a pension fund that required bringing up to working level. Investments in other concerns remained much the same as before. A curious fact revealed by the report is that the number of accidents at guarded level crossings was much greater than where no protection of any kind was provided.

DENMARK

The State Railways in 1936-37

Results of the working of the Danish State Railways in the year ended March 31, 1937, were the best for a number of years. Passenger numbers increased by 9·9 per cent. Of the total increase of 4,500,000 passengers, about 3,200,000 accrued to the Copenhagen suburban traffic owing to the electrification of the Holte line, and about 400,000 dates from increase in the State Railway bus route mileage. The goods and livestock traffic increased by 5·9 per cent. in volume, or 8·3 per cent. in ton-kilometres. The increase is greatest for livestock (23·4 per cent. in ton-km.) and smallest for parcels traffic (5·2 per cent.); for full-wagon load traffic the increase was 8.9 per cent. The increase in passenger receipts, amounting to 6·1 per cent., is mainly due to the causes mentioned above, but also to the growing popularity of the fast diesel express services. Goods receipts increased by 7·1 per cent.

The working expenses were Kr. 4,500,000 higher, or 4·0 per cent. This is mainly due to a rise in train-kilometrage, rising prices of coal, and also in higher staff expenses. Further, a considerable sum has been spent in improving and rebuilding the passenger rolling stock. Finally the heavy snowfalls during the winter 1936-37 caused large expenses.

Operating Results

The net result of the working, Kr. 4,200,000, is more than counterbalanced by the depreciation charges, and if interest expenses are added, the total deficit amounts to Kr. 14,500,000. A comparison of the principal results with those for 1935-36 is tabulated below:—

	1936-37	1935-36
Passengers ...	50,104,400	45,603,300
Copenhagen suburban traffic ...	30,880,200	27,664,700
Other passengers	19,224,200	17,938,600
Goods and livestock, tons	4,717,484	4,457,201
Goods and livestock, ton-km.	577,288,714	534,323,865
	Kroner	Kroner
Passenger receipts...	63,443,936	59,781,450
Goods and livestock receipts	43,775,404	40,861,980
Total gross receipts	122,102,959	113,834,722
Working expenses...	117,888,994	113,345,110
Net receipts ...	4,213,965	489,612
Depreciation charges	6,655,928	6,458,021
Interest	12,015,779	11,169,442
Final deficit ...	14,457,742	17,137,851

The route-length of the system has been reduced by 127 km. during the year by closing certain branch lines, but in spite of this, the number of train-kilometres has grown from 27·7 million to 28·7 million. Of this number, 7·4 million or 25·7 per cent. has been covered by diesel or petrol railcars or trains, and 2·2 million or 7·5 per cent. by electric trains, so that steam locomotives are responsible for only two-thirds of the total train-kilometrage. The State Railways now have 8 diesel articulated high-speed

trains, 12 diesel locomotives; 88 diesel or petrol railcars; and 62 electric motorcoaches; the number of steam locomotives has been reduced to 416.

Private Railways in 1936-37

The numerous small private railways have also been able to show an increase in traffic, as will be seen from the following table, which gives the combined results for all private railways:—

	1936-37	1935-36
Passengers	11,048,876	10,553,801
Goods and livestock, tons	2,561,531	2,531,703
	Kroner	Kroner
Passenger receipts...	8,734,789	7,997,436
Goods and livestock, receipts	8,451,811	8,209,527
Gross receipts ...	20,747,131	19,611,035
Working expenses, including depreciation and part of interest ...	22,312,132	21,253,760
Deficit	1,565,001	1,642,725

Although there was a considerable increase in passenger traffic, the competition from the roads was felt very acutely in goods traffic, and in spite of the improved economic conditions of trade there was only a very small increase in the volume of goods traffic. The increase of 5·8 per cent. in gross receipts is nearly counterbalanced by the increase in expenses, due to higher train-kilometrage, &c. It is interesting to note, that of the total train-kilometrage of 13,422,923, as many as 11,091,748 km. or 83 per cent. were run by diesel or petrol services. In all, the private railways have 184 diesel or petrol railcars and locomotives.

IRISH FREE STATE

Development of Killarney

Killarney, on account of its lakes and beautiful scenery, as well as the lovely surroundings, has long been the principal centre for visitors in Ireland, and it is proposed to develop it by a scheme which has been sponsored by Viscount Castlerosse. The scheme includes an 18-hole golf course, with a luxurious club-house, a trout hatchery, and deer stalking and shooting will also be provided so that Killarney may always be in season for one form or another of sport. By the improvements to be effected the season will be lengthened, bringing greater prosperity in the district with consequential benefit to the railway.

BRITISH WEST INDIES

Barbados Government Railway

According to a "Report on Economic and Commercial Conditions in the British West Indies," issued by the Department of Overseas Trade under date May, 1937, passenger traffic on the Barbados Government Railway ceased in January, 1934, and after investigation of the position of the railway by Mr. E. M. Bland, C.M.G., in February, 1937, a decision was reached by the House of Assembly in April which was regarded as involving the abandonment of the undertaking. This was in sharp contrast with both British Guiana and Trinidad, where the receipts of the Government railways in 1936 showed a marked improvement, with a substantial balance of receipts over working expenditure, and future prospects appear bright.

EGYPT

Cheap Ticket Issues

First, second, and third class excursion tickets at single-fare-and-a-half for the return journey are to be issued at certain stations during the Ramadan Bairam.

New short-period season tickets available over the whole system for periods of from one to four weeks are to be issued during the slack season at the following fares:—

	First Class £E. mm.	Second Class £E. mm.
One week	4·500	2·500
Two weeks ...	8·000	4·000
Four weeks ...	12·000	7·000

CANADA

Montreal-built Locomotives for Mexico

The Montreal Locomotive Works Limited is building three standard gauge, oil-burning, three-cylinder, Pacific type locomotives for the Mexican Railway, the leading dimensions of which are:—

Cylinders ...	20 in. dia. × 28 in. stroke.
Coupled wheels, dia.	5 ft. 9 in.
Boiler pressure ...	200 lb. per sq. in.
Tractive effort ...	41,400 lb.
Tender capacity:	
Water ...	6,000 gal.
Fuel	2,500 gal.

After erection and testing, these engines will be crated for shipment as soon as navigation re-opens in April.

ARGENTINA

B.A.G.S. Feeder Lines

The Government of the Province of Buenos Aires has authorised the B.A.G.S.R. to exploit the system of light economical lines it has constructed in the districts of Tres Arroyos, and Coronel Pringles—subject to the permission of the respective municipal authorities—for the transportation of agricultural produce to the stations on its broad-gauge system.

Proposed State Railway Branch from Maria Grande to Paraná

The Governor of the Province of Entre Rios, and the Lord Mayor of the City of Paraná, recently paid a visit to the Minister of Public Works of the Republic to urge the early sanction by the Central Government of the construction of a State Railway branch 50 km. long between Maria Grande and Paraná, in the Province of Entre Rios, at an estimated cost of $50,000,000 paper. The Minister promised to give the matter preferential attention.

BRAZIL

Leopoldina Railway

A Decree has been signed by the President of the Republic, granting the petition made by this railway, for an extension of the period established in Clause VIII of the contract dated June 26, 1907, with the Federal Government, whereby exemption from the payment of import duties on material necessary for the working and maintenance of the railway, was allowed for a period of 30 years. After various considerations, based on the findings of the Minister of Transport, as reported in THE RAILWAY GAZETTE of December 17 last, the new Decree, which takes effect immediately, stipulates that exemption will continue until such time as the contract may be reformed.

Extended Use of Railcars

More extensive use of railcars is noticeable on the Viação Ferrea do Rio Grande do Sul, where regular services are now in force between Porto Alegre, Caxias, and Taquara; and Pelotas and Rio Grande. The success attending these services led the General Manager of the Rêde de Viação Paraná—Santa Catharina to propose that an experimental trip to Curityba be made by one of the cars, with a view to establishing a definite railcar service. As a result of this proposal, railcar No. 85, carrying a party of engineers and officials from the Santa Maria workshops, was fitted up for the purpose, and covering the 1,700 km. between Porto Alegre and Curityba in 34 hr., it established the commercial speed of 50 km.p.h.; travelling was only by day.

Central Railway

To relieve congestion on the suburban section of this railway, work has begun on a new branch line between Deodoro and Rio de Janeiro Docks, passing through Honorio Gurgel, and over the Central Auxiliar line, the Rio D'Ouro Railway, and Leopoldina Railway. The new line is primarily intended for the transport of minerals—chiefly manganese—for export, and import coal.

Estrada de Ferro Santa Mathilde

This long-established railway, property of the Minas State Government, and running for a distance of 22 km. between Conselheiro Lafayette and Jurema, in the State of Minas, is to be reopened for traffic. Although in a bad state of repair, after years of disuse and neglect, the firm of A. Thum & Company has rented the line for a period of five years, for the transport of manganese (which is in great demand at the present time) from the mines at Bom Jardim, and Cocuruto. In addition to paying 1$000 (milreis) to the Minas State Government, for every ton of manganese carried, the railway will revert to the State, without indemnisation from the latter, on the termination of the contractural period.

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BRITISH RAILWAY STATISTICS

"The Railway Gazette" monthly table for Sept., 1937, as compared with Sept., 1936, compiled from the Ministry of Transport Statement No. 211

Description	Great Britain*	G.W.R.	L.N.E.R.	L.M.S.R.	S.R.
PASSENGER TRAIN TRAFFIC—					
Number of pass. journeys (ex. season ticket holders)	110,969,746	8,299,843	16,800,600	27,098,976	19,549,167
Increase (+) or decrease (—)	+ 2,763,156	+ 197,124	+ 515,596	+ 502,814	+ 625,413
Passenger receipts (excluding season ticket holders)	£5,151,212	£681,515	£1,067,795	£1,671,695	£1,134,817
Increase (+) or decrease (—)	+ £169,447	+ £20,051	+ £46,250	+ £35,866	+ £53,057
Season ticket receipts	£1,022,305	£70,675	£180,374	£266,177	£339,714
Increase (+) or decrease (—)	+ £63,662	+ £2,998	+ £7,555	+ £21,391	+ £24,955
Parcels and misc. traffic receipts (excluding parcels post)	£1,075,766	£203,877	£316,401	£413,859	£122,255
Increase (+) or decrease (—)	+ £1,815	+ £8,383	— £3,767	+ £4,329	— £7,938
FREIGHT TRAIN TRAFFIC—					
Freight traffic (tons) (excluding free-hauled)	23,549,032	5,657,084	10,603,578	10,814,146	1,337,775
Increase (+) or decrease (—)	+ 2,254,041	+ 584,635	+ 869,802	+ 764,282	+ 60,491
Net ton-miles (excluding free-hauled)	1,367,296,417	256,035,705	461,942,765	557,080,767	55,917,996
Increase (+) or decrease (—)	+112,604,799	+ 24,456,708	+ 42,834,471	+ 40,877,879	+ 1,439,571
Average length of haul (miles) (excluding free-hauled)	58·06	45·26	43·56	51·51	41·80
Increase (+) or decrease (—)	— 0·86	— 0·39	+ 0·50	+ 0·15	— 0·85
Freight traffic receipts	£7,427,373	£1,286,000	£2,455,990	£3,058,000	£399,891
Increase (+) or decrease (—)	+ £421,034	+ £76,700	+ £195,990	+ £130,000	+ £7,869
Receipts per ton-mile	1·304d.	1·21d.	1·28d.	1·32d.	1·72d.
Increase (+) or decrease (—)	— 0·036d.	— 0·05d.	— 0·02d.	— 0·04d.	— 0·01d.
Freight train-loads : Average train-load (tons)	131·71	137·99	136·59	129·86	104·02
Increase (+) or decrease (—)	+ 6·68	+ 6·59	+ 7·06	+ 6·39	+ 1·47
Net ton-miles—					
Per train engine-hour	986·47	1,044·77	1,040·80	946·43	794·87
Increase (+) or decrease (—)	+ 8·37	+ 7·90	+ 12·93	+ 0·18	— 9·19
Per shunting-hour	917·78	816·93	1,007·13	965·83	592·00
Per total engine-hour	475·44	458·45	511·84	478·02	339·30
Net ton-miles per route-mile per working day	3,008	2,997	3,227	3,547	1,181
Increase (+) or decrease (—)	+ 259	+ 290	+ 315	+ 284	+ 12
Wagon-miles. Total	382,630,685	69,604,145	134,644,462	159,758,154	17,982,445
Increase (+) or decrease (—)	+ 12,942,727	+ 3,160,115	+ 7,375,792	+ 4,145,599	— 305,315
Percentage of loaded to total	67·58	68·75	65·01	69·20	68·13
Wagons per train. Total	34·74	34·93	35·25	34·73	31·73
Increase (+) or decrease (—)	— 0·03	— 0·15	+ 0·04	— 0·03	— 0·60
Loaded	23·48	24·01	22·92	24·03	21·62
Empty	11·26	10·92	12·33	10·70	10·11
Train-miles. Coaching—Per train-hour	15·28	14·34	14·46	14·53	17·99
Per engine-hour	12·18	11·32	11·09	11·08	15·11
Train miles. Freight—Per train-hour	8·81	9·18	8·96	8·51	9·32
Per engine-hour	3·61	3·34	3·80	3·68	3·22
Engine miles. Total	50,089,276	7,960,383	13,923,244	18,671,886	6,675,520
Increase (+) or decrease (—)	+ 1,330,390	+ 274,175	+ 571,431	+ 418,996	+ 181,053
Mileage run by engines. Total train-miles—					
Coaching	25,362,232	3,438,032	5,868,062	8,353,484	5,024,398
Freight	11,012,807	1,992,795	3,820,199	4,599,842	566,645
Engine-hours in traffic. Total	5,339,094	925,728	1,608,536	2,086,437	527,274
Increase (+) or decrease (—)	+ 207,036	+ 49,060	+ 86,898	+ 80,722	+ 1,774
Shunting miles per 100 train-miles—					
Coaching	7·22	6·95	6·65	7·68	7·45
Freight	71·24	84·06	66·49	65·66	92·03

Passenger Traffic Statistics: Number of journeys, receipts, and receipts per journey (excluding season ticket holders)—September, 1937

Subject	Great Britain	G.W.R.	L.N.E.R.	L.M.S.R.	S.R.	Cheshire Lines	Liverpool Overhead	L.P.T.B.†	Mersey
Full fares—									
Pass. journeys	32,525,509	776,284	1,225,798	1,595,885	2,984,196	16,326	173,275	24,860,571	79,555
Gross receipts	£1,073,568	£103,696	£171,501	£173,754	£259,931	£3,212	£1,756	£341,564	£1,417
Receipts per pass.	7·92d.	32·06d.	33·58d.	26·13d.	20·90d.	47·22d.	2·43d.	3·30d.	4·27d.
Reduced fares—									
Excursion and week-end—									
Pass. journeys	46,096,696	5,069,030	10,612,349	16,926,201	9,619,113	466,682	118,157	1,507,084	617,498
Gross receipts	£3,215,729	£479,856	£724,302	£1,222,134	£671,877	£29,616	£1,255	£34,612	£9,469
Receipts per pass. journey	16·74d.	22·72d.	16·38d.	17·33d.	16·76d.	15·23d.	2·55d.	5·51d.	3·68d.
Workmen—									
Pass. journeys	27,726,207	1,864,510	3,786,648	7,284,205	5,980,346	252,642	224,540	7,200,808	224,582
Gross receipts	£409,640	£27,888	£62,480	£118,771	£99,798	£4,351	£1,819	£81,391	£2,033
Receipts per pass. journey	3·55d.	3·59d.	3·96d.	3·91d.	4·01d.	4·13d.	1·94d.	2·71d.	2·17d.
Other—									
Pass. journeys	4,578,335	580,087	1,163,556	1,274,913	962,804	38,164	46,171	415,625	12,090
Gross receipts	£407,350	£58,686	£99,798	£136,339	£100,443	£3,640	£312	£3,559	£209
Receipts per pass. journey	21·35d.	24·28d.	20·58d.	25·67d.	25·04d.	22·89d.	1·62d.	2·06d.	4·15d.
Total—									
Pass. journeys	110,969,746	8,299,843	16,800,600	27,098,976	19,549,167	774,040	562,143	33,984,088	933,725
Gross receipts	£5,151,212	£681,515	£1,067,795	£1,671,695	£1,134,817	£41,036	£5,142	£461,126	£13,128
Receipts per pass.	11·14d.	19·71d.	15·25d.	14·81d.	13·93d.	12·72d.	2·20d.	3·26d.	3·37d.

* All standard gauge railways

† Includes passengers originating on the railway undertakings, and on the Whitechapel and Bow Joint Railway

RAILWAY PERSONALITIES OF 1838

(*From a correspondent*)

THE important railway developments of 1838* were naturally reflected in the coming into prominence of railway personalities and of special features with which their names were associated. For example, it was in 1838 that Brunel's famous broad gauge of 7 ft. 0¼ in. was first brought into service with the opening of the original section of the Great Western Railway. The two names chiefly associated with "the greatest wonder of the world!"—the description given by many at the time of its opening to the London & Birmingham Railway—were the famous Edward Bury, who was in charge of the locomotive department; and Robert Stephenson, who was engineer for the line, and from then until his death was engaged in railway construction not only in Great Britain, but all over the world. In 1838 William Lindley, a famous civil engineer, became Engineer-in-Chief of the Hamburg-Bergedorf Railway; and Sir Edward Charles Blount became Chairman and financial backer of a company to build a line from Paris to Rouen. Joseph Locke constructed the Sheffield & Manchester Railway; and William Henry Barlow (who took out several patents relating to the permanent way) returned, after six years in Turkey, and became Assistant Engineer on the Manchester & Birmingham Railway.

The great railway pioneer, George Stephenson, became in 1838 Vice-President of the mechanical science section of the British Association at its Newcastle meeting, and many attending that meeting were present at the opening on August 24 of the Durham Junction Railway. Samuel ("Self-help") Smiles, who was later Secretary of the South Eastern Railway, published in 1838 his "Physical Education." Thomas Sutcliffe Mort went out to a Sydney business house that year, and subsequently promoted the first railway line in New South Wales (between Sydney and Parramatta). The famous Marquis Dalhousie (who, as Governor-General, introduced railways into India) succeeded as tenth Earl on the death of his father in 1838; William Rankine became a pupil of MacNeill, Surveyor of the North of Ireland under the Railway Commission; and William Yolland (who became Chief Inspector of Railways for the Board of Trade) was appointed to the Ordnance Survey.

March 6 is the centenary of the death of John Stevens, the famous American inventor, known as "Father of American Railroads." In 1815 he received from the State of New Jersey the first American railroad charter, for a line from Trenton to New Brunswick.

It was fifteen years later, however, that he formed the Camden & Amboy Railway Company, and in 1832 he completed the first railway across New Jersey. His son (R. L.) designed the 'T' or American rail; he had 500 tons of them made in England, and also ordered locomotives from Robert Stephenson. Another celebrity who died in 1838 (On October 1) was Charles Tennant, a famous manufacturing chemist, who was interested in railways, especially in the neighbourhood of Glasgow, and attended in 1830 the historic opening of the Liverpool & Manchester Railway.

Among the more interesting of the celebrities who would have become centenarians had they survived until 1938 are General Michael Annenkow, whose chief claim to fame was the organisation of the Trans-Siberian Railway, which he planned to extend from Moscow to the borders of China. In Paris, in 1891, he made his latest plans known to the French press, and in the following year this undertaking, one of the world's greatest railway lines, was begun. Squire Thornton Stratford Lecky (also born in 1838) was from 1882 to 1898 Marine Superintendent for the Great Western Railway, an office for which he was selected from six hundred applicants. It was his task to supervise the steamship services from Milford Haven and Weymouth, and he practically designed the ships, and supervised their building.

There occurs on July 11 the centenary of the birth of Samson Fox, who began working in a mill at ten, and in 1877 patented the Fox corrugated boiler furnace. In 1886 he patented pressed steel underframes for railway wagons. David Rathmore, Baron Plunket (born December 3, 1838), the famous Irish statesman, was a Director of several railway companies, and was one of the founders of the Central London Railway. Sir Auckland Colvin (born on March 8) was Lieutenant-Governor of the North-Western Provinces of India, and was Chairman of the Burma Railways Company and of the Egyptian Delta Light Railways Company. Another celebrity born in 1838 (on May 1) who was associated with railways in Egypt was Sir Francis Arthur Marindin, who had a distinguished career in the Government service, and became Senior Inspecting Officer of Railways to the Board of Trade. He was created C.M.G. in 1887 for his work on the Egyptian State Railways, and became K.C.M.G. at the Diamond Jubilee in 1897. On December 7, 1838, Sir Thomas Bent was born. He joined the Victorian ministry in Australia in July, 1881, as Commissioner of Railways, and in 1887 became Chairman of the first Railways Standing Committee. In 1902 he was Minister for Railways and Works, and bore the brunt of the great rail strike of May, 1903. On February 16 of the following year he became Prime Minister.

Peter Brotherhood (who was born on April 22 a century ago) was son of Rowland Brotherhood, a railway contractor of Chippenham, and, after training with his father, he was for a time in the G.W.R. works at Swindon. In 1872 he introduced the Brotherhood engine. The American statesman, Colonel John Hay, was born on October 8, 1838; his father-in-law was Amasa Stone, an eminent railway constructor. Hay was distinguished as a journalist and diplomat, and was American Ambassador to England. Another celebrity born in 1838 was Sir William Renny Watson, who was Chairman of the Glasgow & South Western Railway Company.

The year 1838 also saw the birth of various famous men whose work in the sphere of engineering was allied to railways and other forms of transport and communication. Carl Ludwig Schwendler (1838-1882) was a German electrical engineer who worked for many years in the telegraph department of India; and General Charles Webber (1838-1904) was an officer of the Royal Engineers who was an expert in telegraphy and assisted the Post Office to organise its telegraph department. Webber and Sir Francis Bolton in 1871 founded the Society of Telegraph Engineers, now the Institution of Electrical Engineers. William Henry Maw (1838-1924) was one-time President of the Institution of Civil Engineers, and for more than half a century edited *Engineering*. Count Zeppelin, who was born on July 8, 1838, and died on March 8, 1917, left a name that will be associated for ever with the construction of the airship.

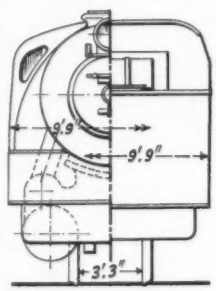
* Referred to briefly in an editorial article on page 5.—[ED. *R.G.*]

XUM

EXPERIMENTAL 2-10-4 LOCOMOTIVE FOR THE SOUTH AFRICAN RAILWAYS

Details of a very interesting design for operating on sections laid with 60-lb. rails

ON page 929 of THE RAILWAY GAZETTE for November 26, 1937, we published a perspective photographic illustration of a new 2-10-4 locomotive with what has been described as a 2-8-2 type tender, acquired by the South African Railways and Harbours administration for experimental purposes, and for hauling heavy loads over sections of line where 60-lb. rails are used. The locomotive, known as "Class 21," was constructed by the North British Locomotive Co. Ltd., Glasgow, to the designs of Mr. A. G. Watson, the late Chief Mechanical Engineer, and under the supervision of the Advisory Engineer in London. The engine is of very large size and power for the 3-ft. 6-in. gauge, and of its ten coupled wheels, the leading pair is arranged with a side-play of $\frac{7}{8}$ in. on each side of the centre line. The first, second, and fifth pairs are flanged, and the third and fourth pairs have flangeless tyres. The engine is designed to be capable of traversing curves of 275-ft. radius, the gauge being widened $\frac{3}{4}$ in.



Part front and rear views of locomotive

The boiler barrel has an external diameter of 6 ft. $7\frac{1}{2}$ in. at the throat plate, and 6 ft. $3\frac{3}{4}$ in. at the smokebox tubeplate, the first ring of the barrel being slightly coned. The firebox is of the round-top pattern, 8 ft. $8\frac{1}{8}$ in. long by 8 ft. $9\frac{7}{8}$ in. wide at the outside of the foundation ring. The boiler shell is constructed of nickel steel plates, and the internal firebox, also steel, measures 7 ft. $9\frac{13}{16}$ in. by 8 ft. 0 in. inside, providing a grate area of 62·5 sq. ft. The brick arch is supported on water tubes, and the length between tubeplates is 22 ft. 6 in. The small boiler tubes are of steel, 136 in number, $2\frac{1}{2}$ in. external diameter, and there are 36 superheater flue tubes, $5\frac{1}{2}$ in. diameter outside. Steam is collected from a steam pipe extending from the vicinity of the firebox tubeplate to the multi-valve header in the smokebox. The superheater comprises 36 short loop elements, $1\frac{1}{2}$ in. external diameter. A rocking grate with hopper ashpan is fitted, the latter fixed to the main framing and having sliding doors at the bottom actuated from the footplate. The engine is fitted with a mechanical stoking apparatus. The smokebox is of barrel formation, and fitted with a spark arrester of the self-cleaning type. The bar frames extend from the front to the hind buffer beams, without joints, and are stayed principally by light fabricated constructions. The bearing springs are located over the coupled and bogie axle bearings, and coil springs are fitted to the front truck. Compensating beams are provided between this truck and the first and second pair of coupled wheels, and also between the third pair of coupled and last pair of rear bogie wheels. The front truck is of the sliding type with check springs of coiled pattern. The rear bogie is pivoted at the front end, the proportion of the weight of the upper structure being transmitted to the bogie through side bolster located between the front and hind wheels. A central bolster is also provided at the rear end of the bogie framing. Coiled side check springs are also used for the rear bogie. The brake gear, applied to the rear of the first three pairs of coupled wheels, is actuated by steam.

The cylinders, placed outside the frames, are cast solid with the half saddle, and fitted with long stroke piston valves, 12 in. dia., actuated by Walschaert valve motion. The steamchests are above the cylinders. Steam reversing gear of the South African standard type is fitted.

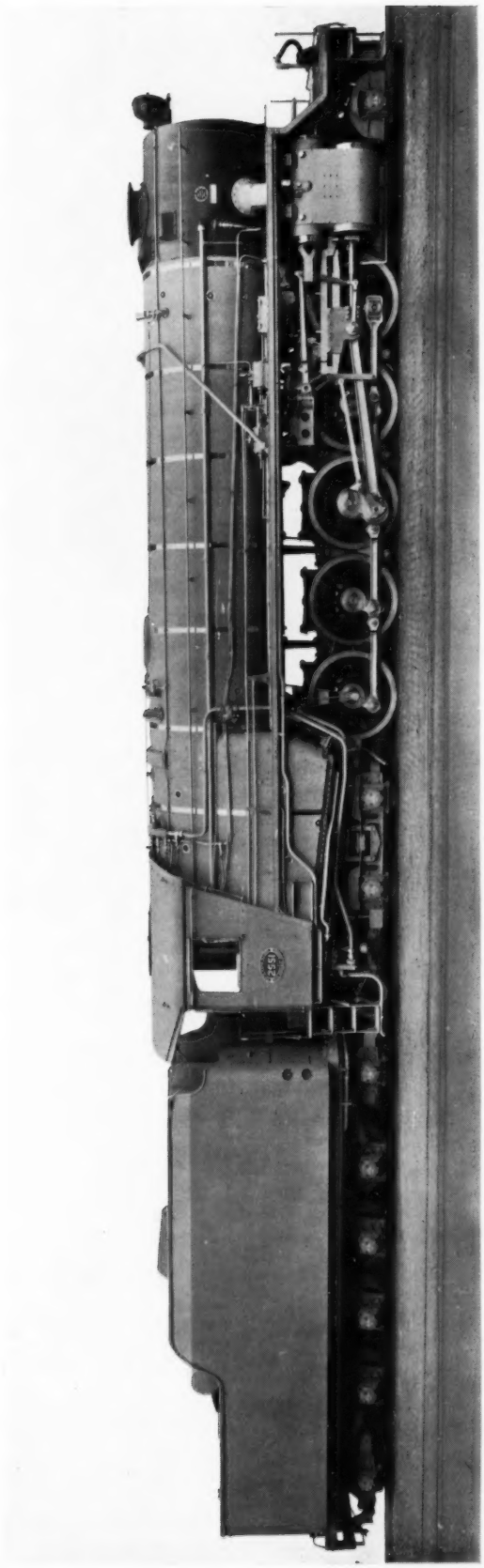
The tender is carried upon five pairs of wheels grouped as a 2-8-2 formation, there being a two-wheeled truck at each end, and, between them, eight wheels mounted in a rigid framing. The tender tank is of welded construction, and has a capacity of 5,750 gallons of water. A coal capacity of 10 tons is provided in the self-trimming bunker. The tender framing is principally of channel sections with plate extensions to which the axlebox guides are fitted. The trucks are of the sliding type with coiled check springs pattern. Overhead laminated bearing springs of the type are used for the eight carrying wheels, and coiled springs for the trucks. The spring gear for each truck and two adjacent carrying axles is compensated throughout the springing system, thus constituting two equal groups. Vacuum cylinders, mounted on top of the tank, actuate brake blocks on the front and back of all carrying wheels.

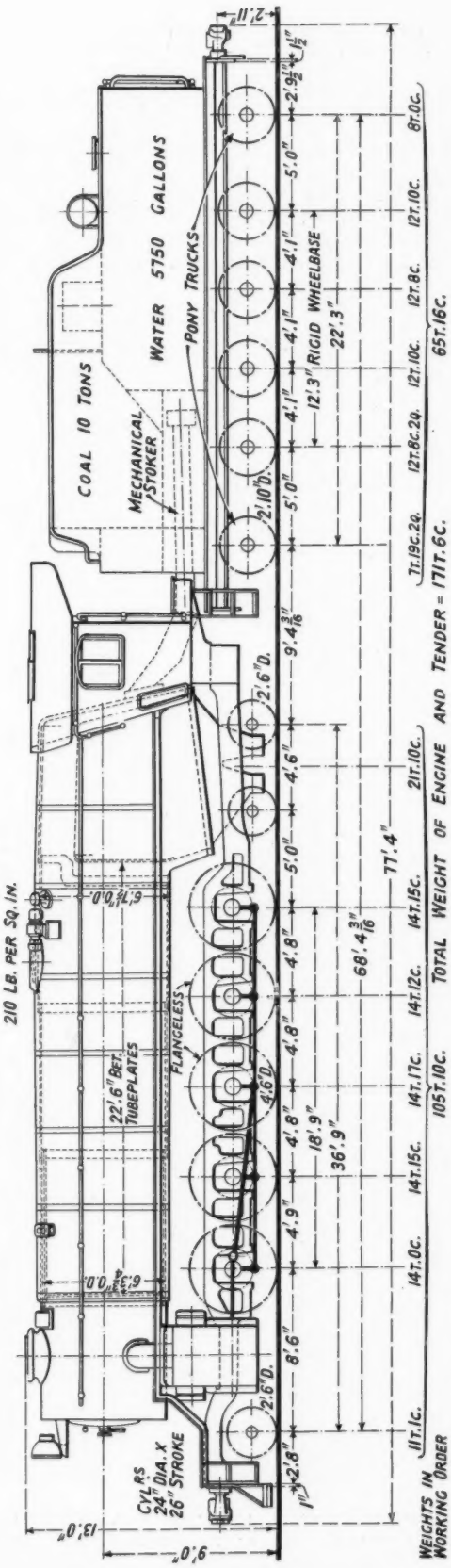
The following are the principal dimensions:—

Cylinders, dia.	24 in.
Piston stroke	26 in.
Wheels, front truck, dia.	2 ft. 6 in.
,, coupled, dia.	4 ft. 6 in.
,, hind bogie, dia.	2 ft. 6 in.
Wheelbase, rigid	14 ft. 0 in.
,, coupled	18 ft. 9 in.
,, total	36 ft. 9 in.
Boiler, heating surface :	
Tubes (including arch tubes)	3,205·2 sq. ft.
Firebox	209·3 ,,
Total (evaporative)	3,414·5 ,,
Superheater	661 ,,
Combined heating surfaces	4,075·5 ,,
Grate area	62·5 ,,
Boiler pressure	210 lb. per sq. in.
Tractive effort at 75 per cent. b.p.	43,680 lb.
,, ,, 85 ,, ,,	49,504 lb.
Tender :	
Wheels, dia.	2 ft. 10 in.
Wheelbase, rigid	12 ft. 3 in.
,, total	22 ft. 3 in.
Weight in working order, engine	105 tons 10 cwt.
,, ,, ,, tender	65 tons 16 cwt.

The principal fittings on the locomotive are as follow: mechanical stoker; Alliance automatic couplers; two Gresham and Craven No. 13 injectors; Clyde soot blower; two Everlasting blow-off cocks; two Ross safety valves $3\frac{1}{2}$ in. dia.; Hasler speed indicator and recorder; Detroit lubricator; Alfol insulation for boiler and cylinders; Stone's electric lighting; steam heating equipment; Skefko roller bearing axle boxes for bogies and tender; Ajax grease lubrication for connecting and coupling rods.

WATERLOO AND CITY RAILWAY.—In a letter to *The Times* of January 3 Sir Harley H. Dalrymple-Hay remarks on the omission from the reports of the meeting between the Chairman of the Southern Railway Company and the "Protest Committee" of any reference to the three 5-chain curves at the bottom of the dip under the south bank of the river (where the speed should be highest) being improved. He goes on to say that these curves could be improved without shutting down the railway for a single minute and that the cost would be small and the expenditure fully justified. Similar alterations have, he adds, been carried out in London during the past few years.





EXPERIMENTAL 2-10-4 TYPE LOCOMOTIVE; SOUTH AFRICAN RAILWAYS

Built by the North British Locomotive Co. Ltd., Glasgow, for operating on sections laid with 60-lb. rails

AN INTERESTING LOCOMOTIVE VALVE-SETTING MACHINE

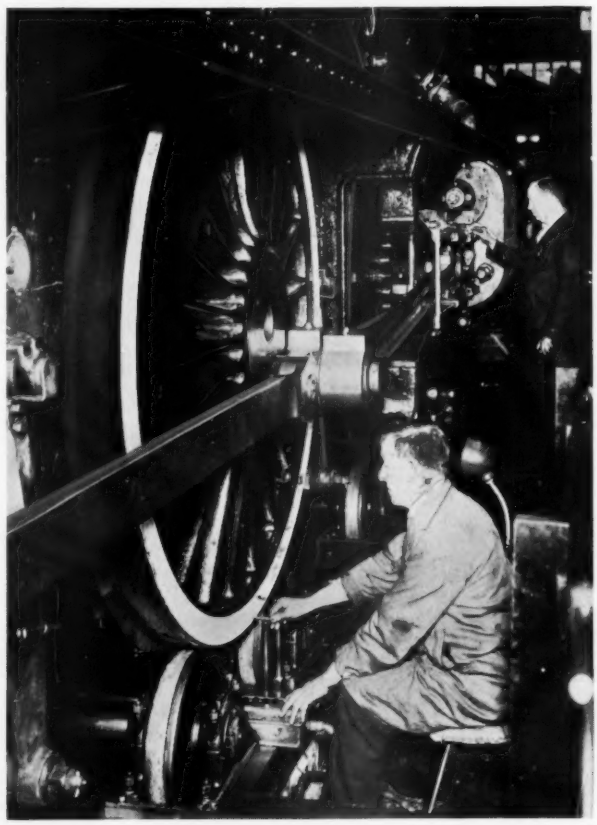
Designed and built at Swindon works, G.W.R.

WHEN setting the valves of a locomotive in the erecting shop, the usual method of moving the engine is that known as "pinching," a bar being used as a lever between the tread of the wheel and the rail; and although this may appear somewhat crude, it is still the method most commonly resorted to in locomotive shops.

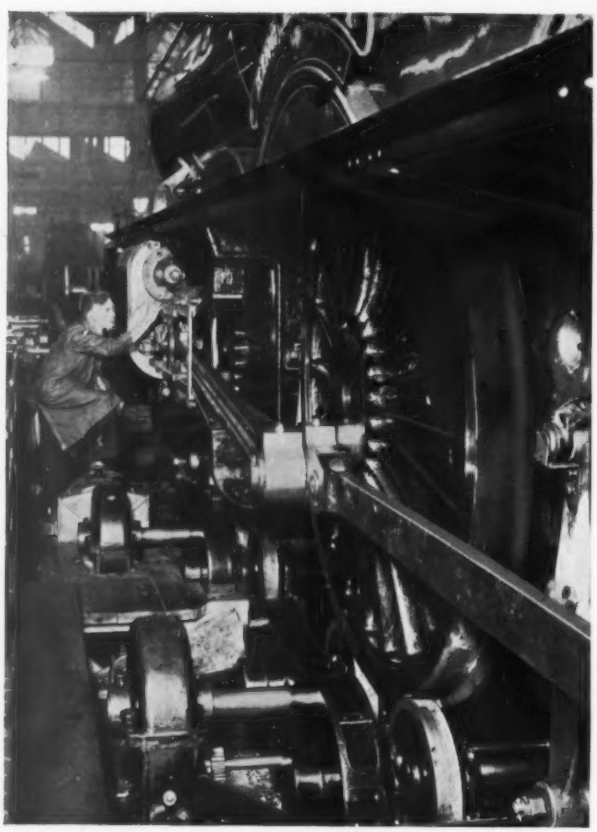
During a recent visit to the Swindon works of the Great Western Railway, we were greatly interested in the working of a machine which has been built and installed there, by which the accurate setting of locomotive valves is conveniently and expeditiously carried out. The machine, which is illustrated herewith, is accommodated in a special pit, and is driven by a 15-h.p. electric motor through reduction gear, suitable shafting, and worm gearing. The illustration shows a "King" class express engine on the machine. Two pairs of locomotive wheels are driven by rollers, and two pairs of idlers are provided for supporting the other wheels of a six or eight coupled engine. One pair of driving rollers is fixed, and the remainder can be adjusted along the bed to suit the various axle centres.

The control is by press buttons—"forward," "reverse," "stop," and "inching." These are situated near the right-hand driving wheel, so that the operator can mark and take the dead centres. A remote flexible push-button control is also provided at the right and left hand at the front of the engine, to enable the operator to control the machine when marking and taking the end of the piston stroke for dead centres and chart readings. The speed of rotation of a locomotive wheel of 5 ft. 8 in. dia., is one revolution in 68 sec.

We had an opportunity whilst in the "A" erecting shop at Swindon, where the machine is located, of trying the controls, and found that the wheels of the locomotive could be moved in either direction by infinitesimal or larger degrees with the greatest ease and convenience. Our thanks are due to Mr. C. B. Collett, O.B.E., Chief Mechanical Engineer of the Great Western Railway, for facilities in connection with the inspection and photographing of the machine.



Main control position. Trammel in operator's right hand from a fixed pillar registers dead centres from centre pops on rim of tyre. Press-button control box is within easy reach of his left hand



Machine controlled by operator near cylinder. Portable push-button giving forward or reverse motion is in operator's left hand

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GOLD MEDALS FOR REICHSBAHN FILMS.—At the exhibition held at Paris recently, gold medals were awarded to two of the films issued by the German State Railway. These were "Blue Riband of the Rails," and "Nord-Sud." The Reichsbahn Film Service formed the subject of an editorial article in our issue of December 24, 1937.

MODERN MICROSCOPY IN RAILWAY WORK

A brief review of the importance of the latest developments in the microscope

By Dipl.-Ing. ALFRED SALMONY, Ph.D.

UNTIL comparatively recently, the use of microscopes was restricted mainly to research work in scientific institutions. Their increasing application to industrial purposes imposed new and higher requirements, resulting in important optical and mechanical improvements in the instruments, the industrial uses of which rapidly extended as their manipulation and capabilities were adapted to the needs of practice. The improvements in question include arrangements for changing rapidly from one kind of illumination to another, and from ocular observation to photographic recording. Combinations of microscopes and cameras, differing in details but all working on substantially the same principles, are now available for all industrial purposes, and the capabilities of these instruments may be illustrated by a few examples taken from the railway field. Safety and economy in railway operation depend essentially upon continual examination of materials, and from the nature of the case, the microscope supplies information available by no other means.

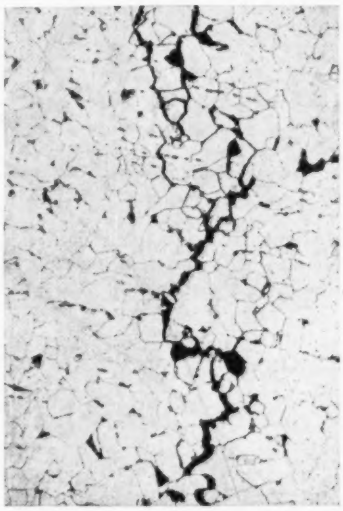


Fig. 1—Crack in boiler plate. Magnification 100 ×

Fig. 2—Boiler plate corroded by the effects of stress and excessive alkalinity of water

The accompanying reproduction, Fig. 1, of a microphotograph taken at 100 × magnification, shows a crack in an otherwise satisfactory boiler plate. Corrosion of a boiler plate, by the combined effects of stress and excessive alkalinity of water, is illustrated by Fig. 2; and Fig. 3 shows cracks due to defective welding in chromium-molybdenum steel; this photograph was taken in the research laboratories of the Fried. Krupp A.-G., Essen. The microstructure shown in Fig. 4 is that of Bahnmetall (railway metal), a hardened lead bearing-metal, containing 0·6 per cent. sodium, 0·7 per cent. calcium and 0·04 per cent. lithium, used in Germany for the bearings of coaches, wagons, and locomotives for medium loads and speeds. This interesting example emanates from an investigation by the Metallgesellschaft, Frankfort-on-Main.

Differences between camera-microscopes relate mainly to the type and arrangement of the camera. In some instances, a mirror reflex camera is mounted at the top of the microscope (Panphot) and in other cases the camera is mounted in the lower part of the apparatus as in the Metaphot, and MeF-Universal equipments

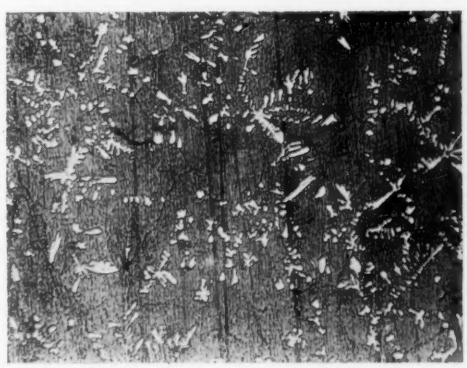


Fig. 4—Microstructure of Bahnmetall (hardened lead bearing-metal). Unetched; magnification 100 ×

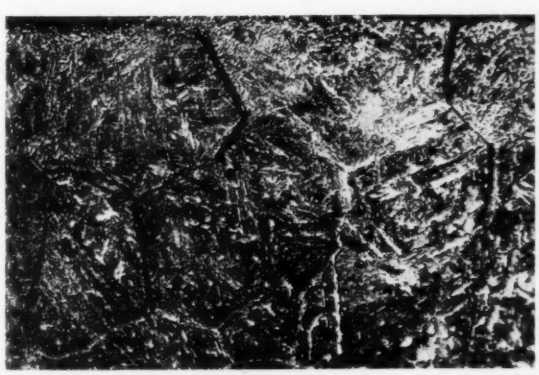


Fig. 3—Welding cracks in chromium-molybdenum steel. Magnification 200 ×

and the Vickers Projection Microscope No. 11 shown in Fig. 5. In the Neophot apparatus, however, made by Carl Zeiss, Jena, the so-called "optical bench" arrangement of components is retained, the bench being mounted on four pot-type dampers which absorb shock and vibration.

One of the latest projecting camera-microscope equipments is the Orthophot apparatus shown in Fig. 6. The evolution of this design is closely associated with the increasing use of microscopy for scientific and industrial investigations involving a great number of observations for statistical purposes. Special importance attaches, in such cases, to comfort in use and ready adaptability to different methods of illumination, ocular examination, photographic recording and projection for drawing, as the case may be. In the equipment shown, the camera is mounted on slides at the left of the microscope and can be instantly removed at any time. A reflecting projector and

XUM

Fig. 5—Vickers projection microscope No. 11

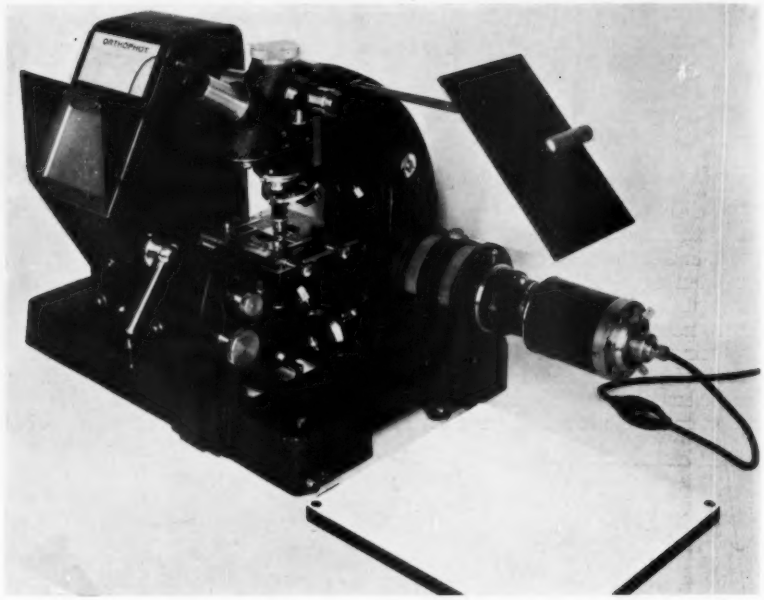


Fig. 6—Orthophot microscope with camera and projection attachments (R. Fuess, Berlin-Steglitz)

drawing board are provided, the whole forming a very compact combination. Where a long series of investigations is concerned, the fatigue of continued ocular observations can often be relieved by viewing the image on the matt screen or drawing board. For the purposes of demonstrations or conferences, it may be more convenient to remove the 45-deg. mirror and project the image on to a vertical screen. Provision is made in this microscope for rapid changing from vertical to oblique or sub-stage illumination, and for combined illumination on Prof. Dr. Hauser's system. In the latter case, a suitably controlled transmitted illumination combines with the vertical illumination to produce an exceptional degree of depth and detail in the image. An example of this is shown in Fig. 7, reproduced from a microphotograph of a nickel wire gauze as used for the first stage of dust removal from the intake-air of a compressed-air braking equipment.

Examination by polarised light is important in many metallographic investigations in railway work; also, in the inspection of lubricants, varnishes, pigments, and other materials. The central portion of the Orthophot apparatus equipped for such examination is shown in Fig. 8. A special polarisation condenser is provided, with a swinging supplementary lens for convergent light and higher magnifications; and the tube carries the analyser. Other features are the rotatable stage and wide-field oculars.

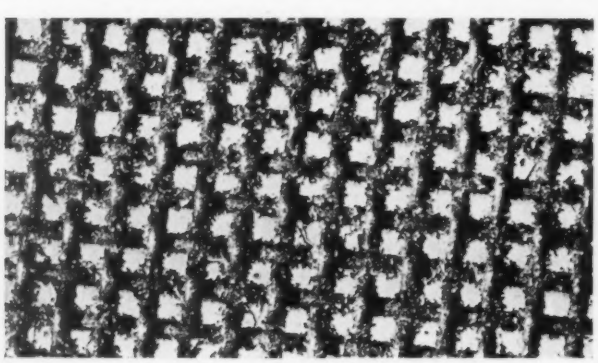


Fig. 7—Microphotograph of filter-gauze as used on compressed-air brake intake. Magnification 28 ×

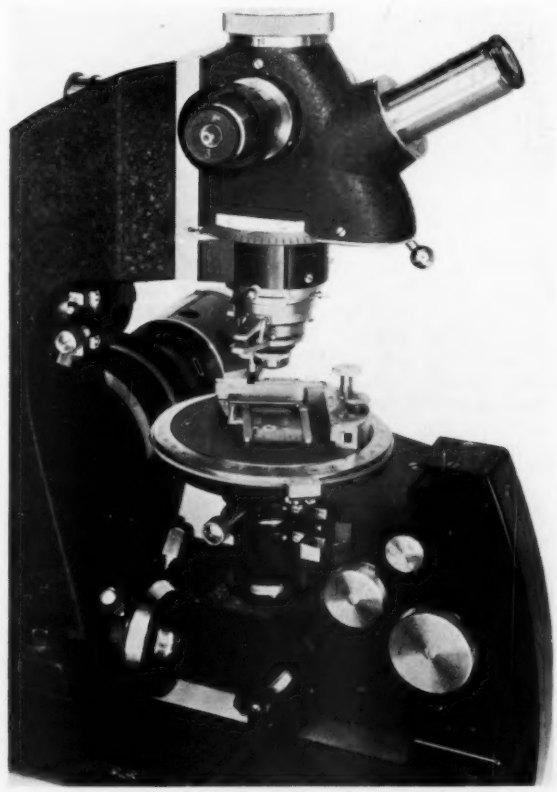


Fig. 8—Orthophot microscope arranged for use with polarised light

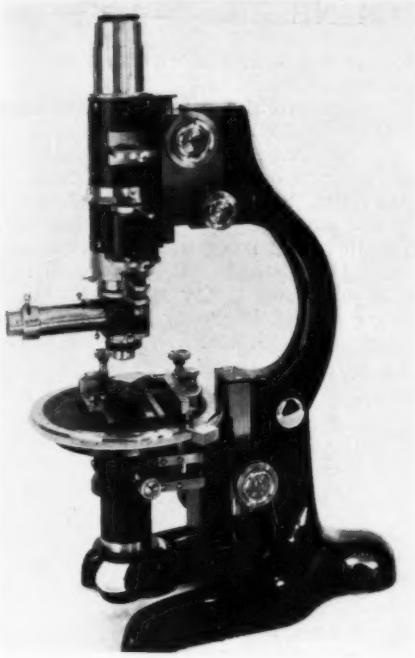


Fig. 9—Portable materials-microscope for the examination of large pieces

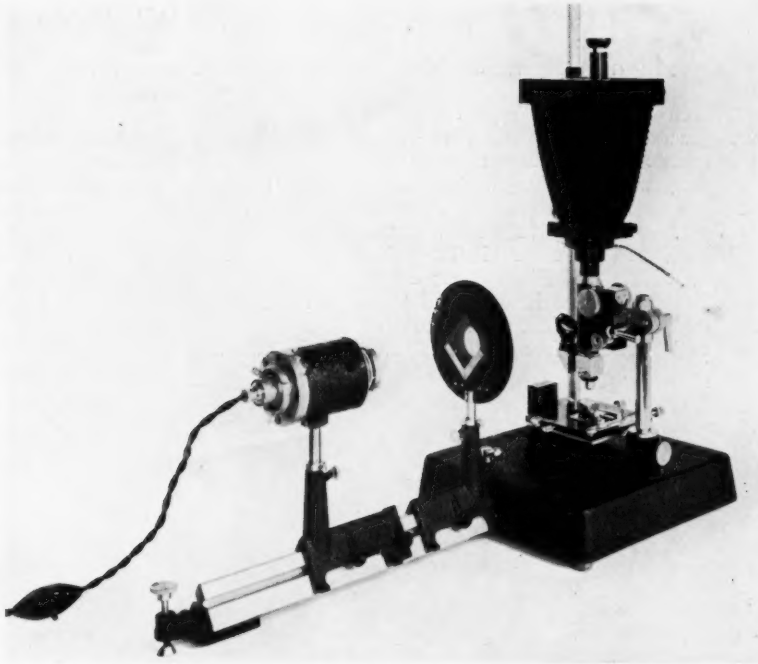


Fig. 10—Portable microscope detached from its stand and applied to photomicrography

A new practical apparatus, specially suitable for the surface examination of large pieces, such as steam cylinders, fireboxes, wheels and other parts, is illustrated in Fig. 9. This instrument weighs about 18 lb. complete with its case, and, for convenience of application to the examination of parts which cannot be moved, it is provided with a number of special devices. The illuminator is fixed to the tube and thus takes part in all focussing movements of the latter. Comparatively thick objects can be mounted on the stage, and, in other cases, the adjustability of the tube in all directions permits the objective to be focussed on the inside of cylinders, the under-surface of rails, grooves, overhung edges, and other parts difficult of access. By removing the foot of the stand and turning it through 180 deg., its vee-shaped opening becomes available for use on axles or other rounds. The portability of the instrument makes it specially useful for examining corrosion on immovable objects; and, on being detached from its stand, the microscope can be used in a photographic combination which includes a vertical bellows-extension camera (Fig. 10).

The following bibliographical references relate to articles which are specially instructive on various phases of practical microscopy:—

"Boiler Damage due to inadequate Feed-Water Treatment," O. Niezoldi, *Chem. Ztg.*, 60 (1936), p. 317.

"Modern Microscopy in Corrosion Research." A. Kufferath, *Korrosion u. Metallschutz*, 1936, No. 7, p. 171.

"Modern Microscopy in the Motor Vehicle Industry." A. Kufferath, *Motor*, September, 1936.

"Some Recent Developments in Photomicrography." E. E. Jelley, *Photographic Journal*, 1934, p. 419.

"An Innovation in the Testing of Materials and its importance in Foundry Practice." A. Karsten, *Die Giesserei*, May 22, 1936.

"Microscopic Examination of Tools, Machine Tools and Motor Vehicle Components." F. Schroeder, *Die Werkzeugmaschine*, 40 (1936), No. 23, p. 557.

Southbound non-stop Sydney Limited, Victorian Railways, passing Kilmore East on September 30, 1937, headed by non-streamlined 3-cylinder "S" class Pacific engine No. 300 with streamlined high capacity tender

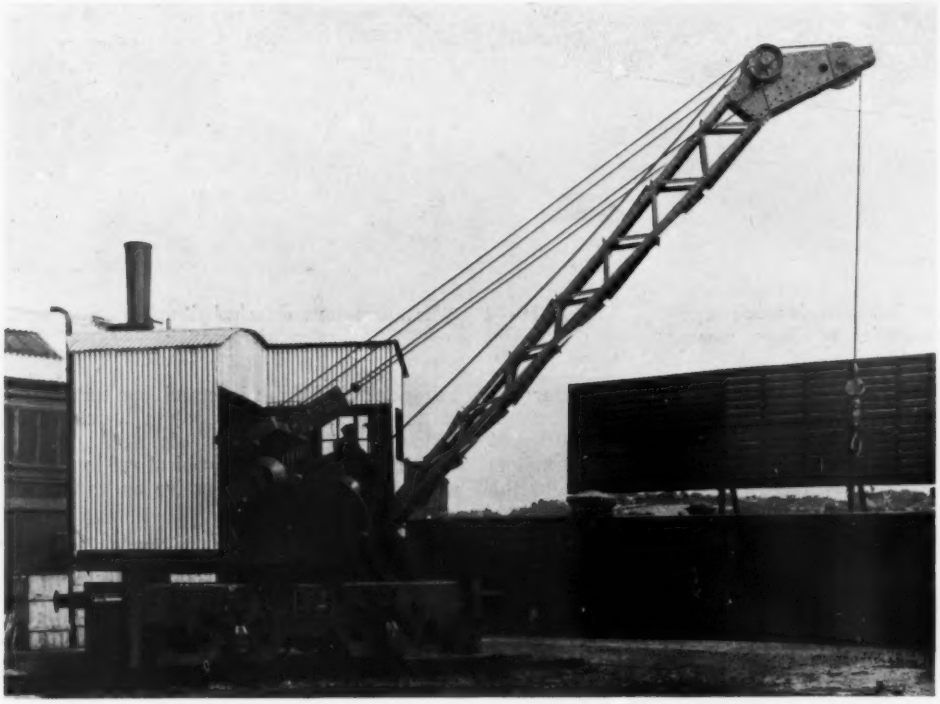
(See also page 11)

XUM

A NEW DESIGN OF STEAM CRANE

An all-steel welded design which overcomes several common steam crane drawbacks

THERE has recently been completed at the works of Joseph Booth & Bros. Ltd.,* Rodley, Leeds, a mobile steam crane embodying several new and interesting features of design. The crane, illustrated below, has been made to suit heavy duty conditions, such as are found in locomotive works, permanent way yards, steelworks, and at other similar points. The standard capacity of the crane is 10 tons at 16 ft. 0 in. radius, down to 3 tons at 30 ft. 0 in. radius. It is fitted with a two-speed hoist for lifting loads of 10 tons at 70 ft. per min., and 5 tons on fast gear at 150 ft. per min. Slewing is effected at from 2 to 3 r.p.m., and derricking at full range in 40 sec. The travelling speed is 350 ft. per min. Power comes from a two-cylinder crane engine, 9 in. bore by 12 in. stroke, supplied from a vertical boiler carrying a working pressure of 120 lb. per sq. in. The total weight of the crane is 48 tons, including 10 tons of loose ballast.



The welded superstructure imparts a neat appearance to the crane as a whole

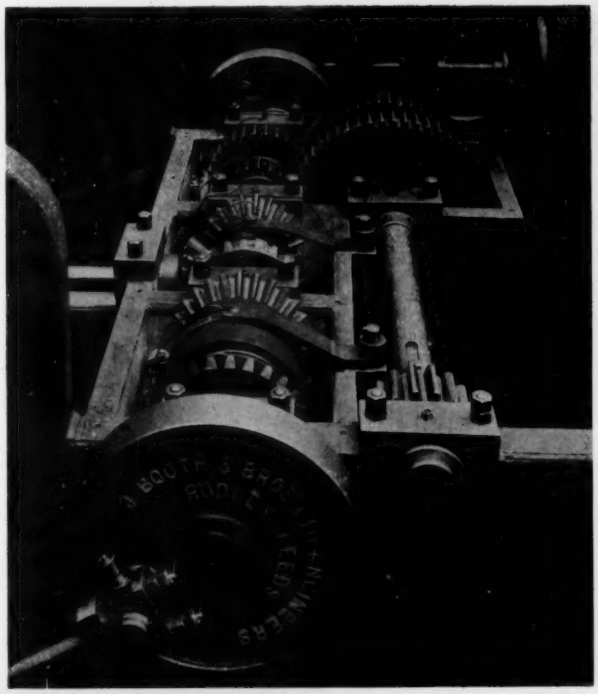
In designing the crane, the principal aim of the builders was to minimise cost without prejudice to the stability and efficiency of the crane, but rather to increase these qualities. The general aim was to provide a unit with simple and inexpensive maintenance, but still representing an advance in steam crane engineering practice. A further point to be considered was that something should be done to eliminate the usual troubles with steam cranes, the causes of which may briefly be summarised as: (1) lack of wear margin; (2) bad lubrication; (3) breakages due to extensive use of cast iron; and (4) bad connections between mechanical and structural portions; and it is claimed for the present design that all these troubles have been eliminated. Respecting wear and lubrication, it is worthy of note that the engine shaft is 4 in. in diameter to the bottom of the splines, and fitted with four bearings, no feather keys being used for the sliding gears and clutches. This shaft is totally enclosed and lubricated by means of a special dry sump lubricating system, a sump being formed in the well at the bottom of the gearbox. The oil is circulated by an eccentric-driven pump, and excess oil is by-passed through a spring-loaded relief valve. Surplus oil drains back into the sump, for filtering and recirculation. The steam cylinders are lubricated by a Wakefield mechanical lubricator. The usual drain cocks have been dispensed with, and Spirex steam traps substituted. It is claimed that engine wear will be very much reduced, due to the elimination of water from the cylinders which this arrangement makes possible.

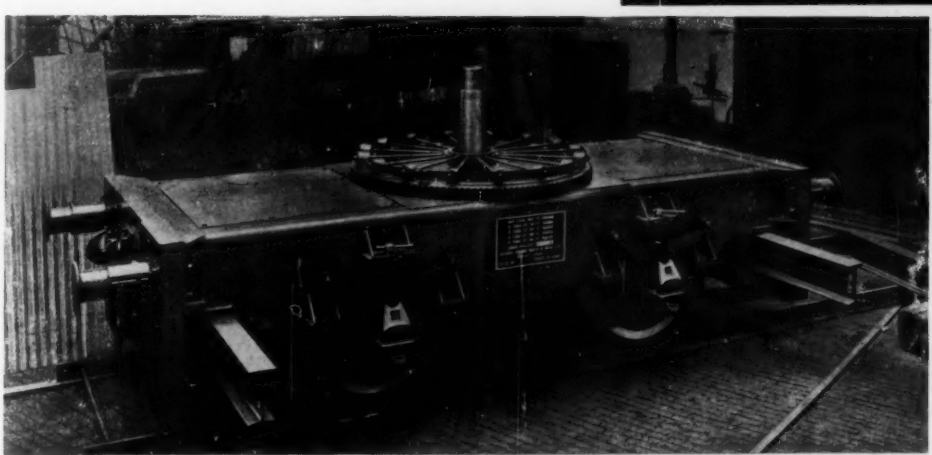
The all-steel welded superstructure of the crane, dispensing as it does with cast-iron components, eliminates bad connections. The welded design further gives a clean and neat exterior to the crane, and at the same time ensures an extremely rigid structure. It will be noted from the general view of the crane that the driving position is at the front, giving the operator a clear and uninterrupted view of the load. The crane is extremely accessible for maintenance, and all lubricating points have been piped out to places where they are readily got at. Although, as already stated, welding is a basic feature of the construction, the jib, as the illustration shows, is

* Joseph Booth & Bros. Ltd., has recently amalgamated with the Clyde Crane & Engineering Co. Ltd. We understand that the new company will continue to supply the same products, and that the type of crane described in this article will be made at the Booth works

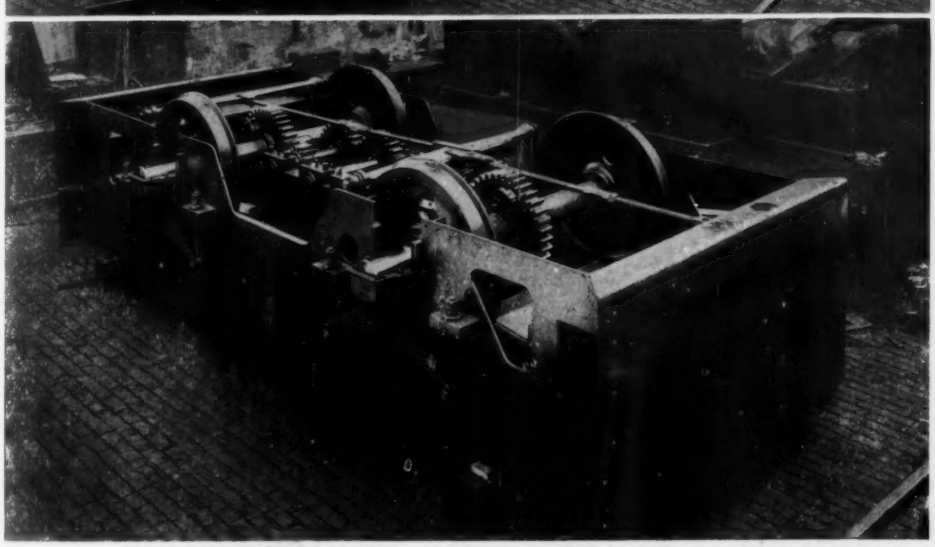
riveted. In this particular design it was not considered that any economy would result from welding the jib, nor did it improve the appearance of the product, so that there was no object in changing the usual design in this respect. The tail ends of the derrick ropes are anchored to a safe load indicator, as provided for in the regulations for all new cranes working under Building Amendment Regulations. The lifting duties are all free on rail, but telescopic blocking girders are provided for additional support when the crane is lifting on bad tracks.

Limitation of space prevents us from going into greater detail with regard to this interesting crane, which, from the point of view of design and construction, appears to be very sound. The crane is in no way experimental, the design having been gradually evolved over a period of ten years. Most of the special features have been embodied by the makers one by one in different designs during the course of years, and the experience gained has been used in designing the present crane. Formerly the practice in building cranes of this description, was to adopt monobloc construction, but later, with the growth of machining facilities, and the advent of a structural steel, the tendency was to make the crane as a series of small parts and assemble them on completion. The tendency has now reverted to the original practice of monobloc construction, but with the very considerable advantages of better material and improved facilities for machining now available.





Above: Engine shaft and gears of the crane. This shaft runs in four bearings and is lubricated by means of a special dry sump system, to minimise wear



Left: Two views of the crane truck, showing the simplicity of construction and compact arrangement of transmission

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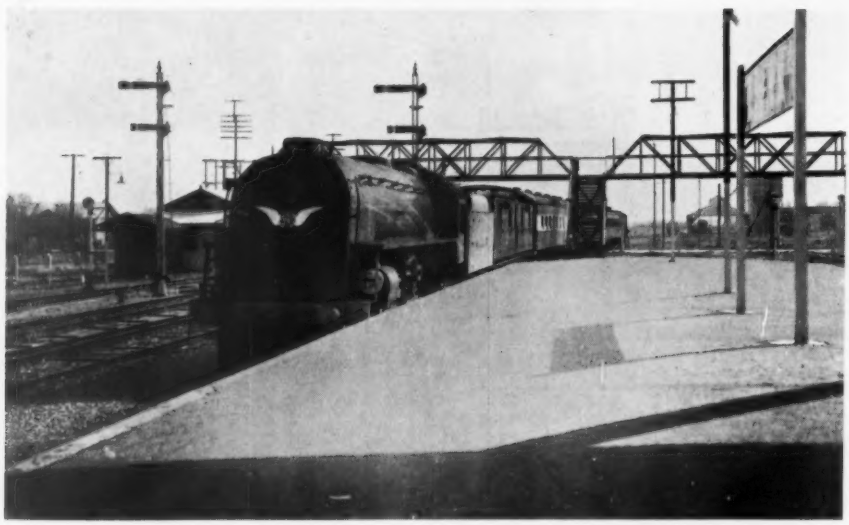
Right: Port Pirie junction, looking down on freight yards from footbridge; 3-ft. 6-in. gauge line on left, 5-ft. 3-in. gauge line centre, and 4-ft. 8½-in. gauge line right. The South Australian broad gauge line, centre, is connected by the crossover which swings left to the narrow gauge line to form a 3-rail track through the yards to Port Pirie (Ellen Street station)



Left: Port Pirie—Adelaide Express entering the station at Port Pirie junction, headed by No. 620 streamlined Pacific engine "Sir Winston Dugan." 5-ft. 3-in. and 3-ft. 6-in. gauge lines and separate booking office for the latter, are on extreme left. The Commonwealth line can just be seen on the right

Right: Port Pirie junction station. Standard gauge track Commonwealth Railways left, 5-ft. 3-in. gauge track right, 3-ft. 6-in. gauge track extreme right. Taken from overhead bridge, foggy appearance in background caused both by haze from the sea and sulphur fumes from smelters

THREE-GAUGE JUNCTION AT PORT PIRIE, SOUTH AUSTRALIA (*See page* 11)

RAILWAY NEWS SECTION

PERSONAL

NEW YEAR HONOURS

Privy Councillor

The Rt. Hon. Sir John Anderson, G.C.B., G.C.S.I., G.C.I.E., lately Governor of Bengal; and a Director of Vickers Limited.

Knights Bachelor

Mr. Charles Bruce-Gardner, M.I.Mech.E., Director of the Bankers' Industrial Development Co. Ltd.

Mr. Harold Nugent Colam, A.M.Inst.C.E., Agent, Madras & Southern Mahratta Railway.

Mr. William Reavell, M.I.Mech.E., lately President of the British Engineers' Association.

Mr. George Reeves-Smith, Member of the Executive Committee of the Travel and Industrial Association.

K.C.I.E.

Mr. Gilbert Wiles, C.S.I., C.I.E., Indian Civil Service, Chairman, Bombay Port Trust.

C.M.G.

Mr. Herbert Branes Emley, General Manager, Sudan Government Railways.

Mr. Garnet Hercules Mackley, General Manager, Railways Department, Dominion of New Zealand.

Mr. Reginald Edwin Robins, O.B.E., General Manager, Railways and Ports Services, Tanganyika.

C.I.E.

Mr. Henry Samuel Rogers Boyagian, Engineer-in-Charge, Meghna Bridge Construction, Assam-Bengal Railway.

C.B.E.

Mr. Walter Henry Gaunt, O.B.E., Member, Transport Advisory Council.

O.B.E.

Commander John Oswald Buckler, R.D., R.N.R., Senior Marine Officer, Kenya & Uganda Railways & Harbours.

Mr. Hubert William Warwick Fisher, M.B.E., Assistant Secretary, Ministry of Transport.

M.B.E.

Mr. Peter Jones, Senior Stationmaster, Nigerian Railway.

Mr. Hubert Guy Ryan, lately Station Superintendent and Hon. Transportation Officer, North-Western Railway.

Mr. Thomas Walton Maughan, Staff Officer, Grade I, Ministry of Transport.

Commander Herbert Francis Whitworth, late R.N.V.R., Rail Transport Officer, Admiralty.

Col. W. G. Tyrrell, D.S.O., late R.E.

Assistant Director of Transportation, War Office, 1933-37

Colonel W. G. Tyrrell, D.S.O., on November 15 vacated on retirement the appointment of Assistant Director of Transportation at the War Office, the highest military railway appointment in peace time. He was gazetted Second Lieutenant in the Royal Engineers in June, 1903, and from October of that year until April, 1905, was at the School of Military Engineering, Chatham, before being attached to the London & South Western Railway for a year. Promoted Lieutenant in December, 1905, he underwent a railway course, and in May, 1906, was posted to the 10th Railway Company, R.E., at Longmoor. From September, 1908, until September, 1913, Colonel Tyrrell was employed with the Canadian forces, and was then for a year with the Depot Battalion, during which time he was promoted Captain. On the outbreak of war in August, 1914, he was posted to Longmoor to command the 10th Railway Company, but did not proceed with it to France until November of that year. During the interval, however, he was able to obtain and collate a considerable amount of engineering, signal, and operating data relating to Continental railways, which were to prove invaluable to the company in its future work. In January, 1916, Colonel Tyrrell was transferred to the Palestine front, where, with the title of Officer i/c Military Railways, he was responsible for the construction and operation of the military railway, which, starting from Kantara on the Suez Canal, was carried across the Sinai Desert into Palestine, and proved a vital factor in the successful prosecution of the campaign.* The construction under active service conditions of some 250 miles of standard gauge line, largely across a waterless desert, and the simultaneous maintenance of an intensive train service on which the force had to rely almost entirely for its subsistence, was a feat of considerable difficulty. The subsequent maintenance over a period of 18 months of an average train service of 22 trains a day in each direction on a line that was single from Rafa (km. 200) onwards—the line from Kantara to Rafa having been doubled in the latter part of 1917 and early 1918—is a tribute to the operating efficiency attained. No wonder, then, that promotion and distinctions came to him rapidly; he was gazetted Acting Major in August, 1916; and Acting Lt.-Col. in February, 1917; was awarded the D.S.O. in June of that year, and was promoted Brevet Major and Major in June, 1918. A year later he became a Brevet Lt.-Col.; in December, 1919, he left Palestine. From March, 1920, to April, 1922, Colonel Tyrrell was employed in Southern Ireland, and afterwards for four months at Woolwich. From August, 1922, to October, 1927, he was in general charge of technical work and instruction at Longmoor, and was subsequently in India until December, 1932. Further promotion came in January, 1929, as Lt.-Col., and as Colonel in January, 1933 (with seniority of June, 1923) to half pay. It was in November, 1933, that Colonel Tyrrell was appointed Assistant Director of Transportation at the War Office. In the course of his work there he has been largely connected with the arrangements for the organisation and training of the units of the Transporta-

* Technical details of this railway appeared in our Special War Transportation Number, September 21, 1919

tion Supplementary Reserve, in which capacity his name will be familiar to a large number of personnel of all grades on the British railways. On page 6 will be found a short editorial dealing mainly with the most interesting phase in Colonel Tyrrell's career, the Palestine campaign.

Herr Gustaf Dahlbeck has been appointed General Manager of the Swedish State Railways from January 1, succeeding Herr Axel Granholm, who has retired. Mr. Dahlbeck was born in 1883 at Ostersund, and after technical training joined the State Railways. In 1927 he was appointed manager of the fifth district, with headquarters at Luleå, and in 1932 he went to Gothenburg as Manager of the second district, from which position he is now promoted. His first term as General Manager is for six years.

Herr Axel Granholm, whose retirement from the post of General Manager, Swedish State Railways, is announced above, is widely known as the man chiefly responsible for the development of the Swedish State Railways to their present high status. Following an engineering training and an extensive career in all major departments of the system, Mr. Granholm was appointed Managing Director in November, 1913, and took office the following year. The tenure of office is six years and Mr. Granholm's fourth such term expires with the past calendar year. In an effort further to avail themselves of Mr. Granholm's talent for organisation, the Government appointed him Chairman of the board of directors of Aerotransport (Swedish Air Lines) in July, 1937. Thus Mr. Granholm's retirement from the Swedish State Railways does not mark his withdrawal from public life, for he expects to devote much of his time to the problems of air transport in Sweden

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The Rt. Hon. Viscount Monsell has been appointed by the Secretary of State for Air to be a Government Director on the board of British Airways Limited.

Mr. Ernest Henry Murrant, Deputy-Chairman of Furness Withy & Company, has been elected a Director of British Airways Limited.

Hofrat Franz Gerstner, who has died at the age of 80 at Mürzzuschlag, was from 1901 to 1909 Chief General Inspector of the Austro-Hungarian State Railway Company. From 1909 to 1919 he was the Director of Technical Services on the board of the State Railways, and from 1919 to 1931 he served as the Austrian member on the International Commission for the Redistribution of Austro-Hungarian Rolling Stock, a body formed from the deliberations at Versailles in 1919.

Mr. H. L. Smedley, whose appointment as Solicitor to the Southern Railway Company was recorded in our issue of December 3, is 52 years of age, and was educated at St. Paul's School, and admitted a Solicitor in 1908. He

Wykeham | *Studios*

Mr. H. L. Smedley

Appointed Solicitor to the Southern Railway Company

entered the service of the London & South Western Railway Company in 1911 and was engaged in Common Law work in the office of Mr. Bishop, the Solicitor to that company. Mr. Smedley served in France during the war and was awarded the Military Cross and Military Medal. He returned to Waterloo early in 1919. After the amalgamation, when Mr. Bishop was appointed Chief Solicitor to the Southern Railway, he became his personal assistant, being engaged in Parliamentary and general work, and in 1930 he was made an Assistant Solicitor (Parliamentary).

At the usual meeting of the traffic officers held at the Irish Railway Clearing House, Dublin, on December 16, Mr. J. Lockhart was unanimously elected Chairman of the Traffic Officers' Committee for the year 1938.

Mr. R. W. Turier, J.P., who has recently retired from the position of Assistant Controller (Scotland), L.M.S. Hotel Services, spent 33 years in the service of the L.M.S.R. and its constituent companies. This brings the combined record of his family in connection with the L.M.S.R. and its predecessors to over a century, for Mr. Turier's father served 48 years, and his grandfather 30 years, with railways subsequently included in the group. Mr. Turier was educated at King's College, London, and began his railway career in the offices of the London, Tilbury & Southend Railway Company at Trinity Square in 1903. In November, 1904, he joined the Midland Railway Hotels Department, serving at headquarters at St. Pancras under Mr. William Towle and his sons. In 1919 he was appointed Resident Manager of the Queen's Hotel, Leeds, under the direction of Mr. Arthur Towle and in 1921 he was transferred to a similar position at the Midland Adelphi Hotel, Liverpool. In 1924 he acted as Resident Manager of the Gleneagles Hotel for its opening and first season. He was appointed Assistant Controller (Scotland), L.M.S Hotel Services in 1925. Mr. Turier was Vice-President of the Scottish Committee of the Hotels and Restaurants Association from its inception, and has recently been elected an Honorary Life Member of the association. In 1935 he was made a J.P. of the County of the City of Edinburgh, a rare distinction for an Englishman and particularly for one with a French name.

Mr. George Gale, the Booking Clerk at Bodmin station, Southern Railway, is serving as Mayor of Bodmin for the current civic year. Mr. Gale is very well known in North Cornwall as a keen transport historian, and he took an active part in connection with the celebration of the Bodmin & Wadebridge Railway centenary in 1934.

LONDON TRANSPORT APPOINTMENTS

The following changes of organisation are announced by the board:—

Department of the Chief Engineer

Mr. V. A. M. Robertson to be Chief Engineer, in succession to Mr. A. R. Cooper.

Mr. H. J. Green to be Assistant to the Chief Engineer.

Mr. T. H. Condy to be Civil Engineer (Maintenance).

Mr. J. H. H. Mason to be New Works Engineer.

Mr. P. Croom Johnson to be Technical Officer in the Chief Stores Superintendent's Department.

Mr. H. Raine to be an Officer of the board as Permanent Way Engineer (Trams).

Department of the General Manager (Railways)

Mr. Evan Evans to be Operating Manager (Railways), in succession to Mr. G. Hally, who retired on December 31.

Department of the Chief Solicitor (Common Law)

Mr. S. P. Jones to be an Officer of the board with the title of Assistant Solicitor (Common Law).

Mr. V. A. M. Robertson, who as announced above has been appointed Chief Engineer, London Passenger Transport Board, was born in 1890 and educated at Dover College and the Crystal Palace School of Engineering. He was articled to Mr. D. Gravell from 1909-12, working principally on London & North Western Railway work, and at the end of his pupilage entered the New Works Department of the South Eastern & Chatham Railway, leaving in 1919 to join the Great Eastern Railway. Enlisting as a private in the London Scottish in 1914, Mr. Robertson was gazetted to the Royal Engineers in 1915. He saw three and a half years' continuous service in France, attaining to the rank of Major in a Field Company, Royal Engineers, and was awarded the M.C. and bar and Mention in Despatches. In 1922 he was appointed to succeed Mr. E. A. Wilson as Divisional Civil Engineer, Southern Division, Great Eastern Railway, and continued to serve in a similar capacity on formation of the L.N.E.R. In 1928 Mr. Robertson was appointed Civil Engineer to the Underground group, which post he held until the absorption of the Underground railways into the London Passenger Transport Board in 1933, and his appointment as Civil Engineer of the board. Mr. Robertson is a Member of the Institution of Civil Engineers, an Associate Member of the Institution of Mechanical Engineers, and a Member of Council of the Institute of Transport. Mr. Robertson represents the Institution of Civil Engineers on a special committee on rails, &c., sitting under the auspices of the British Standards Institution. In 1924 he raised and, with the rank of Major, commanded No. 1 L.N.E.R. Platelaying Company R.E. (Supplementary Reserve), now known as the 150th Construction Company, R.E., S.R. (*see also page* 2).

Mr. V. A. M. Robertson

Appointed Chief Engineer, London Passenger Transport Board

Mr. W. H. E. Humphrey, who, as already announced, has been appointed Assistant Superintendent of Road Transport, Paddington, Great Western Railway, began his railway career in the General Manager's Office, G.W.R., in August, 1900. In 1904 he was transferred to the Goods Department, and after seven years' service on general goods and cartage work was moved to the Chief Goods Manager's Office, where he remained until the outbreak of war; he then joined the Railway Transport Establishment, going to France in March, 1915, and was demobilised in November, 1919. From 1919 to 1927, Mr. Humphrey was Chief Clerk to the District Goods Managers in London, and Worcester, and was also Assistant Goods Superintendent at Bristol. He was appointed Assistant Horse Superintendent at Birmingham in April, 1927, and succeeded Mr. A. Twist as Horse Superintendent, Paddington, in January, 1932.

(*Personal paragraphs continued on p.* 29)

Connaught] [*Studio*

Mr. W. H. E. Humphrey

Appointed Assistant Superintendent of Road Transport, Paddington, G.W.R.

Mr. A. E. C. Dent

Appointed Motor Assistant, Paddington, Great Western Railway

Mr. J. L. Rendall

Appointed Indoor Assistant to the Traffic Manager, Southern Railway

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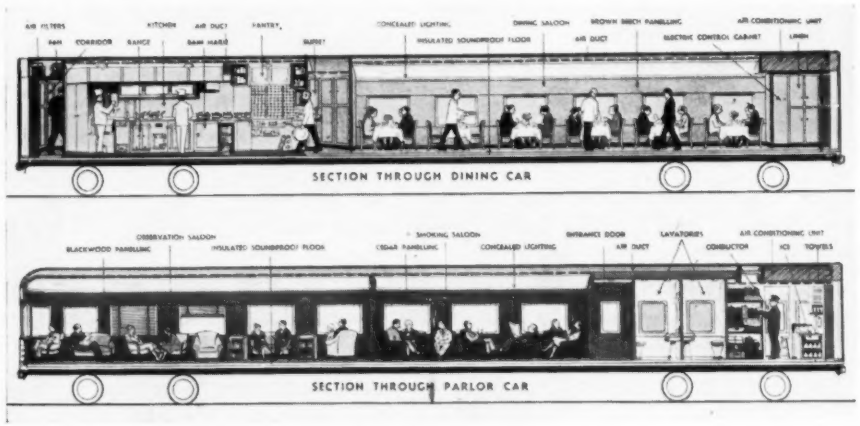


Enlargement of the inset accommodation arrangement shown on poster

Publicity for the Spirit of Progress also includes illustrated booklets describing the train, one of which, produced in colour, is reviewed on page 9. The following is an extract from a similar publication, but of pocket size and including a timetable :—

The Spirit of Progress, which runs daily between Melbourne and Albury, is the last word in train construction in the Southern Hemisphere. Every unit is a solid hull of Corten steel and each is a little world of comfort for the passenger. The marvels of modern science isolate him from the travel irritations of yesterday. Air-conditioning has banished draughts, flies, smuts and excessive temperatures. Selected insulating materials have reduced train noises to an almost imperceptible minimum, and special gear has eliminated vibration even at the train's top speed. The windows are constructed of fixed double panes of unshatterable glass ; and in addition to the soft diffused lighting from the roof there is the appealing novelty of a reading lamp for each passenger.

REPRODUCTION OF A NOTABLE POSTER, ISSUED BY THE VICTORIAN GOVERNMENT RAILWAYS, OF THE NEW STREAMLINED ALL-STEEL TRAIN FOR THEIR SECTION OF THE MELBOURNE-SYDNEY SERVICE. (*See Overseas paragraph on page* 11)

(*Continued from page* 27)

Mr. A. E. C. Dent, A.M.I.A.E., who, as recorded in our issue of December 31 has been appointed Motor Assistant, Paddington, Great Western Railway, joined that company as a premium apprentice in the locomotive works, Swindon, in 1911. In the Great War, he served from 1914-19 with the Royal Field Artillery, attaining the rank of Captain, and returned to Swindon in 1919 to complete his apprenticeship. Mr. Dent was transferred in 1923 to the drawing office of the G.W.R. Road Transport Department at Slough, and in 1925 went to Neath as Assistant Supervisor of Omnibus Services. He was promoted Supervisor of Omnibus Services, Wrexham, in 1927, remaining in that position until his return to Slough as Motor Assistant in 1929, whence he now goes to Paddington.

Mr. J. L. Rendall, whose appointment as Indoor Assistant to the Traffic Manager, Southern Railway, was recorded in our issue of December 31, began his railway career in the Goods Manager's office of the former London, Brighton & South Coast Railway in 1898, gaining experience in all branches of goods commercial subjects. In 1912 he was transferred to the Office of Superintendent of the Line, and appointed Chief Clerk of the Passenger Claims Section. His jurisdiction as Chief Clerk was extended to the Parcels and General Sections in 1917. On the formation of the Southern Railway in 1923, Mr. Rendall was appointed Chief Clerk of the General Passenger Section in the Indoor Commercial Manager's Department. He became Chief Clerk of the Commercial Department in 1930, and Chief Clerk to the Traffic Manager in 1936. Mr. Rendall has held various Railway Clearing House appointments. From 1912-20 he represented the Passenger Department of the L.B. & S.C.R. on the R.C.H. Joint Claims Committee, and from 1913-30 was a member of the R.C.H. Passenger Train Rates & Fares Conference, acting as Chairman in 1918 and 1926. He was a member of the R.C.H. Headquarters Representatives' Meetings from 1917-30 (Chairman, 1926), and of the R.C.H. Road Transport Committee from 1930-33 (Chairman, 1931).

Mr. J. F. Schubeler, M.I.Mech.E., D.I.E.H., has resigned his seat on the board of Sulzer Bros. (London) Ltd., after many years' association with the company. Mr. R. M. Atkinson, hitherto of Vickers Limited, has been appointed to succeed him as from January 1.

Mr. S. G. Barnett, formerly Sales Manager, Cuprinol Limited (manufacturer of wood and fabric preservatives), has joined the firm of Jenson & Nicholson Limited as Manager of the Cuprinol section of that company's business. The change is consequent upon Jenson & Nicholson Limited having taken over from January 1 the distribution of Cuprinol products in the United Kingdom. Mr. Barnett's new address is Jenson House, Carpenters Road, London, E.15.

L.M.S.R. Appointments

The following appointments have been approved by the directors:—

Mr. F. K. Rogers, District Goods & Passenger Manager, Barrow, to be District Goods, Passenger and Docks Manager, Barrow.

Mr. J. K. Wardle, Head of Dock Section, D.G. & P.M.O., Barrow, to be Assistant to District Goods, Passenger and Docks Manager, Barrow.

Mr. J. Thom, to be Assistant Works Superintendent, Crewe (Loco).

Mr. W. P. Henderson, Assistant Chief Chemist and Chemist, Horwich, to be Chief Chemist, Euston.

Mr. A. Neilson, Goods Agent, Rutherglen, to be Assistant Goods Agent, Glasgow (College).

The Rt. Hon. Sir John Anderson, P.C., G.C.B., G.C.S.I., G.C.I.E., has been appointed a Director of Vickers Limited.

Mr. W. A. Smyth, Chief Mechanical Engineer, Ceylon Government Railway, has recently arrived in London on seven months' leave in the British Isles.

Sir Felix J. C. Pole, Chairman of Associated Electrical Industries Limited, has been appointed a representative of the Royal Society on the general board of the National Physical Laboratory, to serve until December 31, 1943.

Mr. A. H. Wright, Assistant District Superintendent, Cambridge, L.N.E.R. since 1929, retired on December 31. Prior to his appointment to Cambridge, Mr. Wright was on the Superintendent's staff, Eastern Section, Southern Area, in charge of the freight train section, and was well-known over the whole of the Eastern Section. On December 30 Col. H. H. Mauldin, Superintendent, Eastern Section, Southern Area, L.N.E.R., presented Mr. Wright with a gold watch, a pair of binoculars, and a cheque which had been subscribed by members of the Superintendent's headquarters staff, and the district operating, commercial, and locomotive officers.

Mr. C. F. Hornsby, who as recorded in our issue of December 3, has retired from the Secretaryship of the Irish and English Traffic Conference, was presented during December with gifts from his friends in the conference and the Claims Committee. Mr. H. B. Webster, Chairman of the conference, in making the presentations, referred to Mr. Hornsby's long association of more than 50 years with the conference, and paid tribute to his ability and courtesy and the willing assistance which he was always ready to give. A number of past members of the conference—Messrs. J. Pike, Rowbottom, and Bailey—honoured the occasion with their presence, as did also Mr. P. Wharton of the Coast Lines; and they as well as Messrs. Barry, Bird, Floyd, Lockhart, Parker, Payne, Richardson, and Mr. Painter of the English Railway Clearing House, spoke in eulogistic terms of their association with Mr. Hornsby.

Mr. A. W. Arthurton, who retired from the secretaryship of the British Railways Press Bureau in 1934, sailed last week for New South Wales to attend the New South Wales 150th anniversary celebrations, and hopes to contribute to The Railway Gazette a series of articles giving his impressions of the celebrations and of travel on the railways of Australia.

Mr. G. V. O. Bulkeley, C.B.E., Director of Transport in Nigeria, has arrived in England on leave.

Mr. F. D. Evans, M.Inst.C.E., Director of Public Works, Nigeria, has been appointed by the Governor to act as Director of Transport during Mr. Bulkeley's absence on leave.

In the last week of 1937 the staff employed at the Atlas works, Gloucester, of Fielding & Platt Limited, assembled to make a presentation to Mr. Frank Fielding, a Director, to mark his completion of fifty years' service with the firm. In acknowledging the presentation, Mr. Frank Fielding said that he regarded the gift as an offering to his co-directors as well as himself. They had never been more successful than of late, and he had every confidence in their future.

We regret to record the death on January 1, at the age of 63, of Mr. W. E. Tyldesley Jones, K.C., who for some years had been one of the leading figures at the Parliamentary Bar. In railway circles he will be remembered in particular as one of the three K.C.'s who appeared for the Southern Railway when the appeal against that company's rating assessment was heard before the House of Lords in 1936, resulting in the reduction of the rating of the railway companies in general. He also regularly represented the London Passenger Transport Board in its applications for Parliamentary powers. He appeared for the Swansea Corporation in the Light Railways litigation in the early days of the Swansea tramways. Mr. Tyldesley Jones was born in 1874, and educated at Clifton. Beginning his career as a solicitor, he gained the knowledge of technical matters which was later to stand him in good stead in the office of the late Mr. Morse, the well-known patent lawyer. After some years he decided to go to the Bar, and was called by Lincoln's Inn in 1905. He took silk in 1920. In 1926 he was made a Bencher of Lincoln's Inn.

XUM

French National Railways Organisation

The French National Railways Company on new year's day took over the seven principal railway systems of France and proceeded with the necessary measures for the unification of the management and at the same time the decentralisation of the executive services. The General Management is installed at the headquarters of the new company, 88, rue Saint-Lazare, Paris (9e). In addition to M. Le Besnerais (General Manager) and M. Surleau (Assistant General Manager), M. Filippi (General Secretary) has his offices there. The Financial Services are at 17, Rue de Londres (9e) and the Pension Service at 11, Rue de Château-Landon (10e). The managers of the five regions (see our issue of December 10) have their offices at the following addresses :—

Northern : 18 bis, Rue de Dunkerque, Paris, 10e.

Eastern : 23, Rue d'Alsace, Paris, 10e. Strasbourg sub-office, 3, Boulevard du President Wilson, Strasbourg.

Western : 20, Rue de Rome, Paris, 8e.

South-Eastern : 20, Boulevard Diderot, Paris, 12e.

South-Western : 1, Place Valhubert, Paris, 13e.

The Société Nationale des Chemins de fer is now generally known from its initials as the S.N.C.F.

The officers of the various headquarters departments (see also our issue of December 10) are as follow :—

Secrétariat Général, 88, Rue Saint-Lazare
Secrétariats du Comité et du Conseil, MM. Grelat et Closset.
Secrétaire Général Adjoint, Chef de la 1ère Division du Secrétariat Général, M. Vagogne.
Secrétaire Général Adjoint, Chef de la 2e Division du Secrétariat Général, M. Antonini.
Secrétaire de la Direction Générale, M. Lenglin.
Secrétaire administratif, M. Renouard.
Chef du Service du Budget, M. Lasserre.
Chef du Service du Contentieux, M. Aurenge.

Service Central du Mouvement, 8, Rue de Londres
Chef du Service, M. Goursat.
Chef de la Division de la Réglementation et de la Sécurité, M. Lemonnier.
Chef de la Div. du Mouvement voyageurs, M. Dargeou.
Chef de la Div. du Mouvement marchan., M. Mermont.
Chef de la Div. des Affairs militaires, M. Nivelet.
Chef de la Div. du Contrôle du Mouvement, M. Narps.

Service Central du Matériel, 20, Rue de Rome
Chef du Service, M. Jean Levy.
Chef de la Division de la Traction, M. Poncet.
Chef de la Div. des réparations du matériel moteur, M. Bloch.
Chef de la Div. des Voitures et Wagons, M. Leroy.
Chef de la Div. des Etudes du Matériel, M. Renevey, assisted by M. Legrand.
Chef de la Div. du Service gén. du Matériel, M. Bertrand.

Service Central des Installations Fixes, 20, Rue de Châteaudun
Chef du Service, M. Porchez.
Chef de la Division de l'Entretien et des Travaux neufs, M. Nebout (sous la direction).
Chef de la Division des Etudes des Installations fixes, M. Leduc (commune de M. Lemaire).
Chef de la Division du Service Général des Installations fixes, M. Commelin.

Service Central du Personnel, 88, Rue Saint-Lazare
Chef du Service, M. Barth.
Chef de la Division de l'Administration du Personnel, M. Lezer.
Chef de la Division des Effectifs, M. Lefort.
Chef de la Division de la Sécurité et des Questions Sociales, M. Dupin.

Service Commercial, 54, Boulevard Haussmann
Chef du Service, M. Boyaux, assisted by M. Marois (development of traffic, advertising, and publicity).
Chef de la Division de la Co-ordination, M. Girette.
Chef de la Division du Trafic Voyageurs, M. Rame.
Chef de la Div. du Trafic Marchandises, M. Escolle.
Chef de la Div. de la Publicité commer., M. Doubrere.

Services Financiers, 17, Rue de Londres
Chef du Service, M. Brochu.
Chef Adjoint du Service, M. Thomas.
Chef de la Div. de la Comptabilité gén., M. Mettas.
Comptabilité Générale, M. Aladenise.
Contrôle des Recettes, M. Armand Bernard.
Chef de la Division des Finances, M. André Bernard.
Trésorerie, M. Lagnace.
Caisse Générale, J. Macquemin.

Service des Approvisionnements, Commandes et Marches, 100, 102, Avenue de Suffren
Chef du Service, M. Leclerc du Sablon

Service de l'Organisation Technique, 8, Rue de Londres
Chef du Service et Commission d'Organisation, M. Dumas, assisted by M. Pierre. Levy (general organisation and statistics).
Chef de la Division des Etudes, M. Dugas.

Service des Retraites, 13, Rue de Château-Landon
Chef du Service, M. Rondot.

The officers of the regional managements (for regional headquarters addresses see above) are as follow :—

Eastern
Directeur de l'Exploitation, M. Renard.
Sous-Directeur à Strásbourg, M. Regnauld, 3, Boulevard du Président Wilson, Strasbourg.
Chef du Service de l'Exploitation, M. Grandjean, 13, Rue d'Alsace, Paris.
Chef du Service du Matériel et de la Traction, M. Wisdorff, 162, Faubourg St.-Martin, Paris.
Chef du Service de la Voie et des Bâtiments, M. Bouche-Leclercq, 23, Rue d'Alsace, Paris.

Northern
Directeur de l'Exploitation, M. Cambournac.
Chef du Service de l'Exploitation, M. Degardin, 18, Rue de Dunkerque, Paris.
Chef du Service du Matériel et de la Traction, M. Lancrenon, 78, Rue des Poissonniers, Paris.
Chef du Service de la Voie et des Bâtiments, M. Flament, 18, Rue de Dunkerque, Paris.

Western
Directeur de l'Exploitation, M. Legoux.
Chef du Service de l'Exploitation, M. Soulard, 13, Rue d'Amsterdam, Paris.
Chef du Service du Matériel et de la Traction, M. Hebert, 44, Rue de Rome, Paris.
Chef du Service de la Voie et des Bâtiments, M. Robert Levi, 49, Rue de Londres, Paris.

South-Eastern
Directeur de l'Exploitation, M. Jourdain. Sous-Directeur à Marseille, M. Lang.
Chef du Service de l'Exploitation, M. Tuja, 20, Boulevard Diderot, Paris.
Chef du Service du Matériel et de la Traction, M. Japiot, 20, Boulevard Diderot, Paris.
Chef du Service de la Voie et des Bâtiments, M. Gerin, 15, Rue Traversière, Paris.

South-Western
Directeur de l'Exploitation, M. Epinay.
Chef du Service de l'Exploitation, M. Berthelot, 1, Place Valhubert, Paris.
Chef du Service du Matériel et de la Traction, M. Cardon, 41, Boulevard de la Gare, Paris.
Chef du Service de la Voie et des Bâtiments, M. Bouteloup, 1, Place Valhubert, Paris.

"Southern Sales"

The first number of *Southern Sales*, the monthly organ of the newly-formed Southern Sales League (see our issues of December 24 and 31) is now before us. Adopting the sub-title "News Review of the Traffic Department," it sets out to present the fortunes and successes of the competition for traffic in a style of cheerful but compelling informality. Mr. Gilbert S. Szlumper, the General Manager, contributes the front-page article to the first number, expressing his hope that the Sales League scheme will benefit the public, the staff, and the shareholders. Mr. E. J. Missenden, the Traffic Manager, also addresses a personal message of encouragement to the staff. Text and illustrations of *Southern Sales* are appropriately printed in Southern green.

Even in this issue, produced before the Sales League competition was under way, the paper demonstrates its intention to be a news review by reporting, with illustrations, the four inaugural meetings at which the details of the plan were explained by officers of the company to delegates from the staff. In other pages, the organisation of the competitions is explained. Stations in the five divisions of the system competing for passenger honours are allocated among four leagues. In the goods competition the five divisions already mentioned—London Central; London East; London West; Southern; and Western—are increased by a sixth, known as the London District Freight Division, in which the London goods depots are distributed among two leagues only, as against the four of the general freight competition. Every station will have a score card showing its position in both leagues week by week during the half-year.

NEW YEAR MESSAGES

SIR RALPH L. WEDGWOOD

Chairman of the Railway General Managers' Conference

The railways of Great Britain can look back on the year 1937 with satisfaction, and they look forward to 1938 with confidence. Side by side with the general improvement in industry, railway carryings have steadily increased during the year, and are still on the upward grade. We may reasonably hope that this tendency has not reached its limit. The part which the companies are called upon to play in the industrial and social life of the country becomes more important year by year. Equally the demands made upon the services which they provide become more exacting. The railways have spared no effort to maintain the standard of their performance up to the level of present-day requirements, and to adapt their services to the ever changing needs of the community. Their passenger trains are continually being accelerated, and this applies not merely to the " crack " expresses but to passenger services generally, whilst each year sees an advance in the standard of comfort of their rolling stock. The mileage worked by express braked goods trains shows a steady expansion, thus extending the range of the " next-day " delivery system, with the help of the feeder services provided by a numerous and efficient fleet of motor vehicles.

The so-called " ancillary " services have not been neglected; refreshment car services have been extended, and the hotels have been modernised. The opening of the new hotel at Leeds strikes a fresh note in comfort and convenience. Steamship services are recovering rapidly from the depression of past years, whilst the new train-ferry services are becoming more popular year by year.

The year which lies ahead will be notable for the opening of the great Empire Exhibition at Glasgow—an event which should be equally stimulating to travel and to industry. The railways wish it every success. It will be their aim to continue, as in the past, to serve the community, and to help in maintaining the present improvement in prosperity.

LORD ASHFIELD

Chairman, London Passenger Transport Board

This season of the year affords a welcome opportunity of sending to the members of the staff my sincere thanks for their help and co-operation in the discharge of our responsibilities to the public of London. The achievements of London Transport in the Coronation Year have been outstanding. We have surmounted many difficulties and, most important of all, we have on the whole more than maintained our high reputation for public service.

It is, thus, with some measure of confidence that I look forward to the New Year, although it is already abundantly clear that it will be an eventful one, and that the board are to be confronted with grave and complex problems. In the discharge of our obligations and in the provision of our services, the board and their officers will in 1938, perhaps more than ever before, need the loyal co-operation and willing assistance of all members of the staff. I ask each and every one of you in your respective spheres to consider afresh how best you can serve the great undertaking with which we have the privilege to be associated.

It will always be our misfortune that we can spare so little time to sit back and critically survey our organisation and our own individual efforts. Day-to-day activities are pressing. We must for ever be moving forward. Already our commitments are large. Some £10,000,000 will be spent on new works and improvements in 1938. Plans include extensions and improvements to the Underground railways and the provision of new rolling stock, the completion of the reconstruction of Chiswick and Acton works and Neasden depot, the conversion of a further 60 miles of tram route to trolleybus operation, and the replacement of the older types of buses and coaches by those of modern design and equipment. So you will realise that the programme for the coming year is a full one.

I am sure, from my experience in the past, that I can rely upon you all to do your best, and to continue to guard jealously our name for service. With your loyal co-operation the board will, I am confident, bring about a happy solution even of the most urgent and difficult problems with which they can be taxed. Unity makes strength, and in the achievement of a united strength, tempered with growing wisdom, lies the ultimate prosperity of London Transport. On behalf of the Members of the board, as well as myself, I send you all warmest wishes for health and happiness in the New Year.

SIR JOSIAH STAMP

Chairman and President of the Executive, London Midland & Scottish Railway

It is with great pleasure that I again take the opportunity of sending, through the *L.M.S. Magazine*, my best wishes for 1938 to all members of the staff. The improvement in traffics which has continued throughout 1937 fortunately shows no signs of ceasing, and I hope that, with the continued co-operation of the staff, the L.M.S. can look forward to still better times.

I have evidence from all parts of the system of the keen interest all ranks are taking in the progress which is being made in improving our services. We endeavour in the *Magazine*, and also through the medium of *On Time* and *Quota News*, to keep you informed of these things, and, in addition, our travelling film units are providing up-to-date cinematograph presentations of the principal events of the year and other special features of interest.

I look forward to 1938 with confidence, and take this opportunity of thanking you for your support.

SIR JAMES MILNE

General Manager, Great Western Railway

May I express my warm appreciation of the services rendered by all members of the staff during the past year and my sincere wishes for a happy and prosperous New Year?

Test Collisions with Wooden Coaches in France

Experiments are now being carried out with wooden coaches reinforced with steel framing intended to give the coaches, in case of collision, similar protection against telescoping as is afforded by all-steel coaches, and thus reduce the loss of life and injuries in accidents. The public demand for the replacement of wooden coaches encounters the difficulty of the great cost involved. An all-steel coach in France costs about a million francs.

Some time ago the State Railways began seeking some means of securing the comparative safety of steel construction in association with the existing wooden coaches. In the workshops at Aytre some coaches were provided with a protective steel framing at a cost of fr. 90,000 each, and it is their resistance that has now been tested in trial collisions. The first tests were made on the 12-mile line from Rochefort to Aigrefeuille, near La Rochelle, which was abandoned several years ago when road buses took over the traffic.

A buffer stop was placed on the line behind the coaches to be tested to prevent their being repelled by the shock of the collision. A train of obsolete coaches, propelled at a speed of about 30 m.p.h. by a locomotive and then released, was allowed to run into the stationary vehicles. Observers were placed at a distance of 200 yd. to avoid being hit by fragments of wreckage; the results were considered as satisfactory. The momentum of the collision was sufficient to sweep away the buffer and the two trains of coaches ran on together for more than 200 yd. The trials were regarded as sufficiently encouraging to warrant a continuation of similar experiments.

ADDRESS CHANGES—The registered London address of the Argentine Great Western Railway Co. Ltd. is now 117, Old Broad Street, London, E.C.2. The registered address of the Coal Owners of Scotland is now 100, Wellington Street, Glasgow, C.2, and the telephone number Central 4471.

XUM

Modern 4-4-0 Locomotive Performance

The Southern Railway "Schools" Class

Some remarkable performances are being put up by the 3-cylinder "Schools" class 4-4-0 locomotives of the Southern Railway since the displacement by the electrification of a number of engines of this type from the Waterloo and Portsmouth service. These ten "Schools" have since been operating on the principal express trains between Waterloo and Bournemouth, including the non-stop Bournemouth Limited, and despite their adhesion weight of only 42 tons, as compared with the 60 tons of the "King Arthur" 4-6-0's, and a total engine weight of 67 tons against the 81 tons of a "King Arthur," have been doing work barely distinguishable from that performed by the larger 4-6-0 engines. Although the Bournemouth Limited is nominally restricted to a total tare weight of 365 tons, and the other hourly Bournemouth trains to 400 tons, limits in both cases laid down for 4-6-0 engines of the "King Arthur" or "Lord Nelson" types, the "Schools" have handled heavier trains than these without loss of time.

In this connection some recent examples of ordinary running on the 12.30 p.m. from Waterloo to Bournemouth may be quoted, in three instances with twelve-coach corridor formations weighing from 376 to 386 tons tare and 405 to 410 tons gross, in the fourth with a thirteen-coach train of 417 tons tare and 445 tons gross, and in the fifth with a 14-coach train of no less than 455 tons tare and 485 tons gross. The table gives details of the principal passing times on these journeys, and the steady running that it shows is evidence that at no point were the engines short of steam, notwithstanding the limited dimensions of their boilers. On the down journey the gradient is against the engine continuously from milepost 20½ to milepost 31, steepening from 1 in 387 to 1 in 298, and again between posts 46 and 52, where it is at 1 in 249, while elsewhere in the initial 56 miles the line is for the most part slightly adverse or no easier than level, so that the demand on the boiler is continuous and heavy as far as Litchfield box, where the unbroken descent to beyond Eastleigh begins.

On the first of the four runs No. 930, *Radley*, surmounted the climb to milepost 31 at 46 m.p.h., and to Wootton (milepost 52) at 43½ m.p.h.; on the second run, with No. 927, *Clifton*, these speeds were both 44 m.p.h.; on the third, with No. 924, *Haileybury*, 47½ and 47 m.p.h.; and on the fourth, with No. 925, *Cheltenham*, 47½ and 46 m.p.h. Maximum speeds reached on the four runs were 62, 63, 61½, and 59 m.p.h. on the level at Hampton Court Junction, 63, 62, 62, and 64 m.p.h. on the slight descent from Weybridge; 62, 62, 63, and 62 m.p.h. on the undulations near Hook; and 78, 80, 83, and 77 m.p.h. on the long descent past Winchester. The 77 m.p.h. on the fourth run was attained at Shawford after the train had been checked by signals to 50 m.p.h. at Waller's Ash. On the third run *Haileybury* maintained an average speed of 77·4 m.p.h. over the 14·6 miles from Micheldever to Allbrook junction, prior to slowing to 60 m.p.h. through Eastleigh, as was the case on each run; a further and very severe slack is required over Northam junction curve at Southampton. On the run last-mentioned *Haileybury* reached Southampton in 86¼ min. for the 79·2 miles—a good performance for a 4-4-0 locomotive hauling a load within 14 tons of the nominal maximum for 4-6-0 engines on the same schedule. On the four journeys the successive average speeds of 55·1, 55·2, 55·8, and 55·5 m.p.h. respectively over the 49·0 miles of continuous "collar-work" from Wimbledon to Litchfield, afford evidence of the consistent character of the work of these engines.

But the fifth run, with *Cheltenham* and the 485-ton train, shows what one of these engines can do when "extended" somewhat, for time was kept to Southampton notwithstanding a bad signal check at a point where speed should rule high. In the early stages the engine was driven easily, to avoid overtaking the 12.27 p.m. from Waterloo, and speeds were 64½ m.p.h. at Hampton Court junction, 55½ before Weybridge, 63 at Byfleet, and 52½ at the top of the long rise to milepost 31. But from there onwards the driver opened out, to speeds of 65½ m.p.h. at Fleet, 62 before Hook and 67 beyond, and a minimum of 48½ m.p.h. at the top of the 1 in 249 near Wootton. Speed had risen to 71 m.p.h. below Micheldever when there came the signal check, to 20 m.p.h., at Waller's Ash; so rapid was the acceleration from here, however, that a maximum of 82 m.p.h. was reached before Eastleigh, and Northam junction was passed on time. For a 67-ton 4-4-0 locomotive hauling (with tender) eight times its own weight, the average speed of 58·0 m.p.h. maintained over the adverse stretch of 49·0 miles from Wimbledon to Litchfield, and the net time of 84½ min. for the 79·2 miles from Waterloo to Southampton Central, were remarkable achievements. On another occasion, with the Bournemouth Limited, loading only to ten coaches of 321 tons tare and 340 tons gross, No. 929, *Malvern*, averaged 65·0 m.p.h. throughout over the 70 miles from Wimbledon to St. Denys, and 62·4 m.p.h. from Wimbledon to Litchfield; Woking was passed in 26 min. 36 sec., Basingstoke in 48 min. 48 sec., Litchfield in 58 min. 19 sec., Winchester in 66 min. 49 sec. ("even time"), Eastleigh in 72 min. 12 sec., and Northam junction, 78·1 miles, in 77 min. 15 sec.; despite a permanent way check immediately after, Southampton Central was cleared in 79 min. 48 sec. Bad signal checks were experienced between here and Redbridge, but Bournemouth Central, 107·9 miles, was reached in 116 min. 12 sec. (on time), the net time from Waterloo being 112 min. as compared with 116 min. scheduled. Speeds were 71 m.p.h. at Hampton Court junction, 72½ at Byfleet, 58½ at milepost 31, 68 at Fleet, 50 minimum at Wootton (the engine here had been eased), and 82 after Winchester. There has been an all-round improvement in locomotive performance on the Bournemouth line, and punctuality has materially improved.

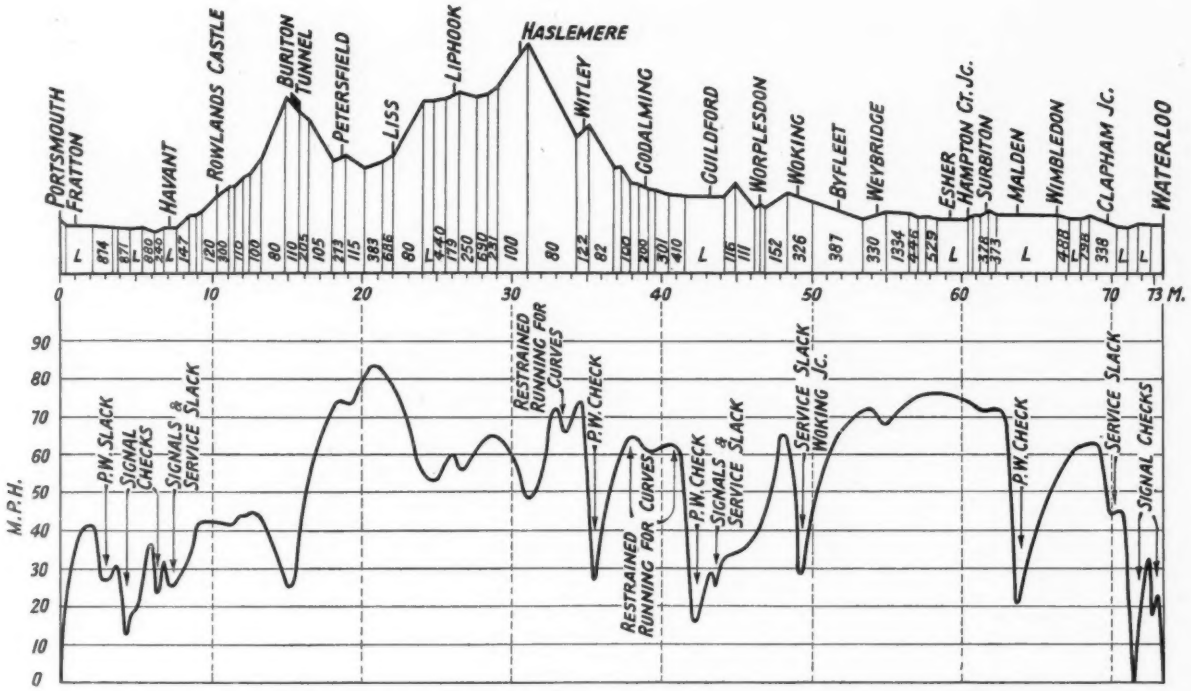
By way of contrast, from the gradient point of view, a speed diagram is reproduced of a run with one of these locomotives over the Portsmouth line shortly before the electrification came into use. For a route with a ruling gradient of 1 in 80, and with inclina-

LOGS OF RUNS WITH "SCHOOLS" CLASS 3-CYLINDER 4-4-0 LOCOMOTIVES BETWEEN WATERLO AND BOURNEMOUTH, SOUTHERN RAILWAY

Dist-ance	Engine, 4-4-0 No. / Load, coaches / ,, tons tare / ,, ,, gross	Schedule	930	927	924	925	925
			12	12	12	13	14
			376	385	386	417	455
			405	410	410	445	485
Miles		mins.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.
0·0	WATERLOO	0	0 00	0 00	0 00	0 00	0 00
				sigs.			
3·9	CLAPHAM JUNCTION	7	7 54	8 49	7 35	7 43	7 46
7·3	Wimbledon	—	12 22	13 18	11 43	12 10	12 27
13·3	*Hampton Court Junction*	18	19 01	19 44	18 14	18 58	19 08
19·1	Weybridge	—	24 44	25 24	24 09	24 59	24 52
24·4	WOKING	29½	30 03	30 49	29 35	30 10	30 13
31·0	*Milepost* 31	—	37 58	38 57	37 24	37 45	37 42
39·8	Winchfield	—	47 16	48 05	46 41	47 02	46 14
47·8	BASINGSTOKE ...	54	55 30	56 10	54 35	55 06	53 48
50·3	*Worting Junction* ...	57	58 31	59 09	57 29	57 57	56 31
56·3	*Litchfield*...	—	65 45	66 31	64 20	65 05	63 18
						sigs.	sigs.
66·6	WINCHESTER ...	—	74 41	75 24	72 54	74 55	74 32
73·6	Eastleigh†	79½	80 10	80 53	78 13	80 36	80 00
				sigs.			
78·1	*Northam Junction** ...	84½	84 50	87 26	83 13	85 10	84 24
79·2	SOUTHAMPTON CEN.	87½	87 36	91 09	86 15	88 12	87 20
79·2	Net times (min.) ...	87½	87½	87½	86¼	87	84½

* Service slack, severe. † Service slack, slight.

XUM



Load: 11 cars, 330 tons tare; 395 tons full (train quite full); Engine: 3 cyl. 4-4-0 No. 925 *Cheltenham.*

Speed diagram of run, Portsmouth—Waterloo, before electrification came into use

tions of 1 in 80 to 1 in 120 in considerable stretches, a load of 360 tare tons (390 tons gross) was very heavy for an engine of such dimensions; yet, inclusive of a sequence of permanent way checks, due to electrification work in progress, as well as signal checks, one of which brought the train to a stand, the loss on the 90-min. schedule was only 3 min. 48 sec., and with a clear road a gain of 8 min. on booked time might have been expected. The principal features of the hill climbing were a drop of only 19 m.p.h. (44 to 25) up ¾-mile at 1 in 100 and 1¾ miles at 1 in 80 to Buriton summit, a minimum of 52½ m.p.h. up 2 miles at 1 in 80 from Liss (following on 83½ m.p.h. maximum beyond Petersfield), and the remarkable minimum of 48½ m.p.h. at Haslemere summit, after the final 2 miles up at 1 in 100. Then the engine maintained an average speed of 72·2 m.p.h. over the 9·7 miles from Byfleet to Surbiton, with a maximum of 77 m.p.h. on slightly easier than level track at Esher.

A permanent way check to 27 m.p.h., and two signal checks to 13 and 25 m.p.h., caused the first 7·2 miles from Portsmouth to Havant to take 14 min. 8 sec.; then came times of 17 min. 13 sec. from Havant to Petersfield (11·5 miles, booked 18 min.), and 11 min. 12 sec. from Petersfield to Haslemere (11·9 miles, booked 13½ min.). Permanent way checks to 27 and 15 m.p.h. were experienced between Haslemere and Guildford, but the latter town, 43·3 miles from Portsmouth, was passed only 2¼ min. late, in 57 min. 10 sec., and Woking, 49·2 m.p.h., in 65 min. 6 sec. (booked 63 min.). Then came the fast running already mentioned, which took the train past Hampton Court Junction, 60·3 miles, in 74 min. 59 sec., 1½ min. late, and with good prospect of arriving punctually, but owing to further signal checks, one a dead stand, the total time for the 73·6 miles from Portsmouth to Waterloo was 93 min. 48 sec. On this journey the cut-off remained fixed throughout at 29 per cent., and all adjustments to meet variations in the power demand were made on the regulator; furthermore, the main valve of the regulator was not opened during the journey, the first port only being used, and up the steep incline to Haslemere the latter was not more than three-fifths open. This is a method of working, in place of full regulator and short cut-offs, that is in evidence on several recent locomotive types, not only on the Southern but on other railways. Mr. O. S. Nock was responsible for recording this run from Portsmouth to Waterloo.

"Schools" class locomotive No. 931, "King's Wimbledon," on Birkenhead-Bournemouth through train near Reading West, G.W.R.

THE QUARTER'S RAILWAY LAW

Expectation of Life

Trubyfield v. *Great Western Railway Company* (1937), 4 *A.E.R.*, 614.

An entirely new problem created by the Law Reform (Miscellaneous Provisions) Act, 1934, is that of the amount of damages to be given in a case of death from personal injuries due to negligence on the ground that the victim has been cut off from his normal expectation of life. This is reckoned in his personal right as if he were living, and his executors can recover at law damages for the difference between the age at which death occurred and the normal span of life. The above case was that of a little girl of eight years. Owing to the negligence of the driver of a horse and cart belonging to the defendants the girl was knocked down on the pavement and suffered injuries from which she died nine days later. The sister who was with her at the time recovered £25 for the shock which she had suffered, the father recovered £21 for funeral expenses, and £50 for her pain and suffering before her death. Then there was this claim for damages for the shortening of her life.

Commenting on *Rose* v. *Ford* (1937), A.C. 826, Mr. Justice Greaves Lord said that according to the speeches of the House of Lords in deciding that case the social position of the deceased did not affect the amount payable. One had to consider life as a whole with all its various incidents.

In the case of a person of 23 years the Court of Appeal had recently awarded £1,000. In the case of this child of eight years the learned judge assessed these damages at £1,500. " In estimating the amount," he said, " one must not consider what the deceased person himself would take for his life, but only what life was worth *considered as a good thing*."

In *Armsworth* v. *South Eastern Railway Company* (1847) Baron Parke, a great lawyer and judge, observed that a man had a legal right in his own life. This entitles him to complain if his life, as a whole, is impaired by another's negligence, not only for the pain and suffering, but if its normal expectancy is shortened in consequence.

It is on these lines that the value of a life is to be assessed under this heading. The task of assessment, as was pointed out in *Rose* v. *Ford*, is a difficult one, but it is not impossible, and these cases give one some idea of the amount at which, on a reasonable computation, the loss will be assessed by the Courts in the interest of the estate of the deceased person.

New Law as to Fatal Accidents

Morgan v. *Scoulding*. *The Times*, December 9, 1937.

While on this subject of the expectation of life the above case is useful as throwing some light on the position, where death is instantaneous. The plaintiff's son was killed in a collision between a motor cycle which he was driving and the motorcar driven by the defendant, who was found liable on the ground of negligence. It was argued for the defendant that as death took place instantaneously the driver of the motor cycle had no cause of action, neither therefore had his administrator, the plaintiff. It was said that the Law Reform (Miscellaneous Provisions) Act, 1934, gave no right of action in such a case. The answer is that the cause of action was not necessarily the death, but the negligence which caused the collision. The cause of action thus arose before the death, and the action descended to the administrator.

In the result the parents were awarded £300 under Lord Campbell's Act and £1,000 to the plaintiff as administrator of the son's estate for the loss of expectation of life.

A caution should be added that it is not necessary that a person should be dead before a claim can be made under the Act of 1934 for loss of expectation of life. A person whose life might be considered as shortened as a result of the accident is also entitled to a sum by way of damages.

Emergency Workers and Compensation

Blee v. *London & North Eastern Railway Company*, 1937 W.N. 374.

The danger of interfering with the county court judge sitting as arbitrator in Workmen's Compensation cases is emphasised by the House of Lords in *Blee* v. *London & North Eastern Railway Company* (supra). The workman there was an acting ganger in the employ of the railway company. He was killed in a street accident while going to fulfil an emergency call on the railway, and the familiar question arose whether the accident arose out of and in the course of his employment. The man's normal hours were from 7.20 a.m. to 5 p.m. But it was a term of his contract that he might be ordered to come and do emergency work on the railway out of hours. On this particular evening he had gone to bed, when he received a message to go to Hornsey sidings, where some trucks had been derailed. He left at 10.30 p.m. to go to work, but was run into by a car while on his way and received injuries from which he died. His widow claimed compensation. The county court judge thought there were special facts in the duties attached to the emergency call, from which he could infer that from the time when the workman left home he was " actually engaged in the performance of his contract of service." There was no misdirection, but the Court of Appeal thought that no distinction should be made between this emergency work and the ordinary case of a workman going to his daily work in the morning, in which case he would not be entitled to compensation for injuries for street risks in transit. His employment then does not begin until he reaches the place of employment: *Alderman* v. *Great Western Railway Company* (1937) A.C. 454. They therefore reversed the county court judge, but the House of Lords restored his decision, holding that if the judge has come to a conclusion on the facts and there is evidence to support the finding, it should not be disturbed by the higher court, even if they do not agree with his finding of fact, he being the final judge of facts as borne out by the evidence.

Carrier's Licence and Right to Hold Inquiry

Re Road and Rail Traffic Act, 1933. *Woodward's Case*. 54 Times L.R. 216.

The Road and Rail Traffic Act, 1933, s. 11 (5) enables a licensing authority, on application for a carrier's licence, to hold an inquiry. But the same section (subs. 3 (b)) provides that the section is not to apply on an application for a licence to expire not later than an existing licence, under which the vehicles are authorised to be used for a business which the applicant has acquired.

The applicants (Woodwards) were haulage contractors at Radcliffe (Lancs.). In March, 1937 one Thornley held an A licence under the Act to use a lorry until April 30, 1938. Thornley died in March, 1937 and his widow applied for and was granted a licence for the unexpired part of the term.

The business was taken over by Mr. and Mrs. Woodward who applied in May, 1937 for a licence to use the vehicle. The assignment of the business to the purchasers was not executed until June, 1937. Upon the application being made the licensing authority wrote saying that the applicants could not avail themselves of the exception to s. 11, subs. 3, of the Act, and that the application must be published with a view to a public inquiry as on an application for a new licence. This would of course invite opposition and the applicants replied that, as they were taking over a business with a licence for a particular vehicle still unexpired, no inquiry was necessary. Matters being at a deadlock, the application went up to the High Court for decision. The learned judge held that to get out of section 11 it was necessary to show the licensing authority that the application related to a vehicle which was authorised to be used for a business which the applicant had acquired or intended to acquire. But here the vendor had ceased to carry on business at the time of the sale. That took the application out of sect. 11 (3) (b). Therefore the licensing authority were entitled to hold the inquiry which they proposed. It was a matter entirely in their discretion and the applicants could not object. The question of granting a licence or not was thus left entirely open, and would abide the result of the inquiry.

Some Engineering Works in France

At the meeting of the G.W.R. (London) Lecture & Debating Society on December 16, at which Lord Cadman presided, Mr. R. Carpmael (Chief Engineer, G.W.R.) gave a lecture illustrated by lantern slides on "Some Engineering Works in France." The lecture was the fruit of visits of inspection in France during the last three years, which had been arranged by the Alliance Française. In 1935 an inspection was made of the Alsace-Lorraine Railways, the inland waterways of the Rhine and Rhone, and the railway from Nice to Coni near the Italian frontier. A notable structure inspected on the Alsace-Lorraine Railways was the Viaduc de Waville on the line between Lerouville and Metz. The striking feature of this viaduct, 488 m. long and with a maximum height of 25 m., which because of the treacherous nature of the soil had had to be built of as light a material as possible, was the slenderness of the ferro-concrete piers of the approaches to the main spans.

The inland waterways system of France, which enabled barges having a capacity of some 1,500 tons to pass from the North Sea to the Mediterranean, was very impressive. An example of the works involved was the Kembs canal, part of the Rhine navigation system, which had obviated the necessity of transhipment at Strasbourg. Some lock gates on this canal were shown, which lifted vertically instead of swinging on vertical hinges. The lecturer described how, after travelling down the Rhone on a tug, the Canal du Rove, between the Rhone and Marseilles, was inspected from the air. This canal involved the construction of a tunnel over 4½ miles long through rock, electrically equipped for the haulage of barges capable of carrying 1,500 tons.

The Nice—Coni railway,* passing through mountainous country, presented many interesting engineering works; for instance the spanning of a ravine filled in spring by glacial floods, by steel girders centrally supported by a masonry arch. On this line too, the presence of sulphates of magnesia at one point had necessitated the use of aluminous cement, a similar difficulty to that experienced at Ruislip recently.

In 1936 a visit was made to the Marèges power station in the Massif Central. Here in the heart of the Auvergne were generated some 300 million kW. a year by means of a huge arched dam, 300 ft. high, built to withstand a thrust of 450,000 tons. The speaker explained the structure of the arched dam, compared with the gravity dam which was invariably seen in this country; the stability of the former depending mainly on the supports at each end, while that of the latter depended mainly on its foundations. The arch of the Marèges dam had a degree of flexibility which was not destroyed by the use of steel anchor cables connecting the crown and the foundation. The Paris-Orleans railway had recently been supplied with power from this district.

During a subsequent tour the harbours round the Brittany coast from St. Malo to L'Orient were visited. At St. Malo the problem of lock leakage had been overcome to an extraordinary extent. At Le Verdon, the new ocean port of Bordeaux, the opening of the port had depended on the possibility of dredging at the mouth of the Gironde, an operation of unusual difficulty as it could not be carried out from moored dredgers since the position was exposed to a very heavy swell. A very notable structure was the Albert Louppe bridge opened in 1930, spanning the Elorn between Brest and Plougastel. The three main spans, each of 610 ft. and 115 ft. high, were the longest ferro-concrete spans in the world. The bridge carried road traffic on the top level, but there was provision for the light railway of the district. As the coast in that region was very dangerous, the lighthouses had considerable engineering interest. The Nividic lighthouse, near the Isle of Ouessant, could not be manned, but the foghorns and lights were electrically controlled from the shore. At another, the Jument d'Ouessant, it was proposed to anchor it to the rock by cables in a similar way to the Marèges dam. All these works were under the control of the Ponts et Chaussees department, which looked after them very efficiently.

Perhaps one of the most exciting structures seen was the Garabit viaduct on the Marvejols-Neussargues section of the Midi Railway. This viaduct, designed by Eiffel and constructed of wrought iron in 1880-1884, was the highest one of its kind in the world, the distance between rail and river levels being 407 ft. In closing, Mr. Carpmael paid a tribute to the Alliance Française, a body which had made possible the exchange of ideas between English and French engineers, and particularly to Mlle. Salmon, its Secretary, who was present.

* Described in THE RAILWAY GAZETTE of November 2, 1928.

Forthcoming Events

Jan. 7 (*Fri.*).—Institute of Transport (Nottingham Graduate), at Guildhall, 7 p.m. "Operating a Scattered Fleet," by Mr. L. Gage.

Omnibus Society, at Inst. Marine Engineers, The Minories, London, E.C.3, 7 p.m. Annual General Meeting and paper by Mr. Charles E. Lee.

Railway Students' Association (Edinburgh), at Goold Hall, St. Andrew Square, 7.30 p.m. "Recent Trends in Railway Progress Abroad," by Mr. C. E. R. Sherrington.

Jan. 8 (*Sat.*).—Stephenson Locomotive Society (Midlands-Northern), at 4, Bury Old Road, Manchester, 6.30 p.m. "Hunting for Railway Relics," by Mr. B. Baxter.

Jan. 10 (*Mon.*).—Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 5.30 p.m. "The Work of the Northern Ireland Road Transport Board," by Mr. D. Clarke.

Permanent Way Institution (London), at Underground Railways' Dining Club, Pelham Street, S.W.7, 7 p.m. "Standard Track of Western European and American Railways: Comparisons with British Standard Track," by Mr. C. E. R. Sherrington.

Stephenson Locomotive Society (London), at King's Cross Station, L.N.E.R., 6.30 p.m. "The Railway History of South Wales and its Relation to Industrial Development," by Mr. S. Beaver.

Jan. 11 (*Tues.*).—Institute of Transport (Birmingham), at Queen's Hotel, 6 p.m. "The Value of Inland Waterways to Home and Foreign Trade," by Mr. E. Bayliss.

Institute of Transport (Leeds), at Hotel Metropole, 6.30 p.m., "The L.N.E.R. Continental Services," by Mr. A. Gibson.

Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. "Recent Engineering Developments in the G.P.O.," by Sir George Lee.

Permanent Way Institution (York), at Railway Inst., Queen Street, 6.30 p.m. "Slag Ballasting," by Mr. H. Clarke.

Jan. 12 (*Wed.*).—Institute of Transport (Manchester-Liverpool Graduate), at Exchange Station Hotel, Liverpool, 6.30 p.m. "Encouraging Road Transport Passenger Traffic," by Mr. H. Hooley.

Institute of Welding (Manchester), at College of Technology, 7.30 p.m. "Carbon Arc Welding and Welding in Structural Works," by Mr. K. Reiter.

Institute of Welding (Scottish), at Royal Philosophical Inst., 207, Bath Street, Glasgow, 7.30 p.m. "Resistance Welding," by Mr. S. Gordon.

Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. "The Purchase and Use of Concrete in a Pre-Mixed Form," by Mr. R. Stanger.

L.N.E.R. (York) Lecture and Debating Society, at North Road Inst., Darlington, 7.15 p.m. Debate with Darlington Society: "That the Railways of this Country are Progressive." Affirmative: York Society. Negative: Darlington Society.

Royal Society of Arts, John Street, London, W.C.2, 3 p.m. "Railway Wonders of the World," by Mr. Cecil J. Allen.

Jan. 13 (*Thurs.*).—Diesel Engine Users Association, at Caxton Hall, Caxton Street, London, S.W.1, 5 p.m. Report on Heavy Oil Engine Working Costs, 1936-37.

Institute of Fuel (London), at Junior Inst. of Engineers, 39, Victoria Street, S.W.1, 6 p.m. "The Combustion of Anthracite Duff in Pulverised Form," by Mr. J. Mayer.

Institute of Metals (London), at Society of Motor Manufacturers, 83, Pall Mall, S.W.1, 7.30 p.m. A Selection from Institute Papers.

Institute of Transport (Scottish), at Grosvenor Restaurant, Gordon Street, Glasgow. Annual Dinner.

Institute of Welding (Leeds), at Keighley. "Oxy-Acetylene Welding Methods," by Mr. F. Clark.

Institute of Welding (Scottish), at Heriot Watt College, Chamber Street, Edinburgh, 7.30 p.m. "Resistance Welding," by Mr. S. Gordon.

Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "British Narrow Gauge Railways," by Mr. L. T. Catchpole.

Railway Students' Association (London), Houghton Street, W.C.2, 6 p.m. "The Construction of New Railways," by Mr. A. S. Quartermaine.

Southern Railway (London) Lecture and Debating Society. "Modern Office Organisation," by Mr. S. Wood.

Jan 14 (*Fri.*).—Institute of Transport (Manchester-Liverpool), at Grand Hotel, Manchester. Annual Dinner.

Institute of Transport (Newcastle), at Royal Station Hotel, 7.30 p.m. "Goods Traffic by Rail," by Mr. G. Atkinson.

Institute of Transport (Newcastle Graduate), at Royal Station Hotel, 6 p.m. "Salesmanship in Transport," by Mr. H. Palmer.

XUM

NOTES AND NEWS

Home Railway Dividend Dates.—The dates upon which the four British main-line railways will announce their final dividends for 1937 are: Southern, February 7; G.W.R. and L.M.S.R., February 11; and L.N.E.R., February 18.

British Railways Press Office.—This office, which is under the direction of Mr. John R. Hind, has removed from 35, Parliament Street, S.W.1, to St. Ermin's (South Entrance), Caxton Street, Westminster, S.W.1. The telephone number is WHItehall 3366.

U.S.A. Railway Employees.—According to a report issued by the Bureau of Statistics of the Interstate Commerce Commission, the number of employees on Class I railroads in the United States, in the middle of November, 1937, totalled 1,060,296, a decrease of 2·91 per cent., compared with the corresponding month of 1936, and 4·98 per cent. below the figure for October, 1937.

Collision at Cannon Street, S.R.—Cannon Street station was closed for four hours last Tuesday after a collision between an empty passenger train and a light engine. The tender of the engine was derailed, blocking two lines, but no one was hurt. The morning rush hour was over when the collision occurred, and trains were diverted to Charing Cross or were stopped at London Bridge.

G.S.R. Increased Charges Applied.—All charges for passengers, merchandise, and livestock carried by the Great Southern Railways of Ireland were increased by 5 per cent. on January 1. This follows the assent of the Railway Tribunal to claims put forward by the company. The decision of the tribunal was fully reported in our issue of December 10, and an account of the evidence heard and a summary of the text of the judgment appeared on December 24 and 31 respectively.

Railway Lectures to Boys.—Mr. Cecil J. Allen lectured to an audience mainly of boys on "Railway Wonders of the World," at the Royal Society of Arts, in London, on Wednesday. This was the first of two lectures under the Dr. Mann Trust. Mr. Allen illustrated his lecture with a wealth of striking pictures, some of which showed the streamlined trains which have done so much to stimulate lay interest in railways. A tribute was paid to the Great Western Railway for having set the standard of high speed that had now become general.

Auto-Trucks for British Industries Fair.—Twenty-four auto-trucks, supplied by R. A. Lister & Co. Ltd., of Dursley, Gloucestershire, are to be used in installing the exhibits at the Birmingham Section of the British Industries Fair in February. Lister auto-trucks have for many years been used for this purpose, but this is the biggest number the organisers have ever commissioned. An auto-truck, designed as a mobile milk bar, will be the centre-piece of the Lister display at the fair.

Assam Railways and Trading Company.—The directors decided to redeem on January 1, 1938, the outstanding six per cent. ten-year notes.

Leopoldina Railway Rates Increase.—The Brazilian Government has authorised the Leopoldina Railway Company to increase its rates for parcels and goods traffic by 10 per cent. from January 15.

North Eastern Airways Bookings.—From December 21 tickets for the North Eastern Airways London–Scotland and cross-country services have been available from agents also dealing in railway tickets.

Great Western of Brazil Debentures.—The question which has arisen in connection with a proposed moratorium on the 4 per cent. debentures involves the relative priority of the 6 per cent. permanent debenture stock and the 4 per cent. debentures to bearer. The board has therefore decided to apply to the High Court for a judicial decision. The matter is one of urgency as the interest on the four per cent. debentures was due on January 1. The formal meeting of the debenture holders has been deferred pending the decision of the Court.

Tientsin-Pukow Railway Loans.—In connection with the Tientsin-Pukow Railway loans of 1908 and 1910 the Hongkong & Shanghai Banking Corporation, under authority from the Chinese Government, has given notice that acceptances by the bondholders of the terms of the Chinese Government's offer already published in London and Berlin, in so far as they concern the funding of a part of certain interest coupons, must be lodged with the paying agents for the loan in London, the Hongkong & Shanghai Banking Corporation, within 12 calendar months from December 31, 1937.

Pullman Car Company's Capital Reduction Scheme.—In a circular to its shareholders the Pullman Car Co. Ltd. sets out the capital reduction scheme in which it is explained that the rolling stock has been valued at £720,000 and the equipment at £21,000, making an aggregate of £741,000, compared with the present book value of £1,274,617, a difference of £533,617. The company has issued and there is outstanding £100,000 4½ per cent. debenture stock and has the right to issue a further £100,000 of like stock. The authorised and issued share capital is £625,000 in 7 per cent. cumulative preference shares and £500,000 in ordinary shares, a total of £1,125,000 (all fully paid up). As reduced and reorganised under the proposed scheme, the company's capital would be: £437,500 in 5 per cent. cumulative income stock; £187,500 in "A" ordinary shares of £1 each; 500,000 "B" ordinary shares of 2s. each, £50,000; and the amount of existing paid up capital available for writing down cars and equipment, £450,000—a total of £1,125,000.

Rail and Road Season Tickets for Moscow.—The Transport Board of the Moscow Soviet is working on a scheme for monthly, quarterly, and yearly tickets enabling a passenger to travel on any branch of town passenger transport (underground, tramway, trolleybus, and omnibus). It is also planned to introduce single tickets permitting a change from one means of transport to another.

Chinese Railway Disasters.—It is reported that on January 3, as a result of a subsidence of the roadbed near Shiuchow, in the north of Kwantung Province, a Canton-Hankow northbound train was derailed and over 100 persons killed and injured. On the same day over 42 persons were killed and many injured when a train from Canton to Wuchang ran into the debris of a collapsed tunnel damaged by a Japanese air bombardment.

The Nord and the Nord-Belge.—It is announced that the Northern Railway of France will continue to work the Nord-Belge Railway, although its concession for working the Nord system in France was transferred to the new French National Railways Company by the Agreement of August 31, 1937. The offices of the Nord, which continue to deal with all matters affecting the Nord-Belge system, have since January 1 been at 3, Rue Chauchat, Paris, 9e; the transfer office remains at 18, Rue de Dunkerque, Paris, 10e.

New Italian International Rolling Stock.—Supplementing previous information given in THE RAILWAY GAZETTE concerning the improvement in rolling stock on the State Railways, it is understood that the Officine Meccaniche of Milan has delivered 15 passenger cars for use on international services. These O.M. all-metal coaches seat four a side third class and three a side second and first class (formerly there have been four a side in Italian second class compartments). The third class seats are upholstered in sponge rubber covered with dark velvet. The imported timber and the bronze and brass work formerly used in the furnishing of Italian passenger cars have been replaced in these new vehicles by light metal alloys produced in Italy.

The Canadian Railway Problem.—Mr. Howe, Canadian Transport Minister, announced at Boston on December 17, that the deficit on the Canadian National Railways this year would be under $40,000,000, as compared with $43,000,000 last. Gross earnings are expected to exceed $200,000,000, the highest for several years past. He pointed out that though the Canadian railway problem was serious, it must be remembered that its 24,000 route miles of line, considered

on the basis of population, was twice that of the U.S.A., and four times that of any other country; yet the freight rates per ton-mile were the lowest in the world "and must remain so in the national interest."

Baltimore & Ohio Railroad Company.—Application has been made by this company to the Interstate Commerce Commission for approval of a new Reconstruction Finance Corporation loan of $8,233,000 (£1,647,000), to meet its 1937 deficit, which it estimates at $1,352,000 (about £270,000). The company alleges inability to obtain funds from private sources. It already owes the Finance Corporation $79,842,000 (£15,968,000). Net income in 1936 was $4,538,000.

New Port Railway Station at Marseilles.—Work has begun in the Joliette basin, Marseilles, on the construction of an important railway passenger station, to be used for boat trains and the garaging of taxis and other vehicles used for conveying passengers to and from the station. The contract for this work has been let to the Entreprise Chagnaud and the Grands Travaux de Marseille. The foundations will include the driving of about 800 Franki piles each capable of carrying a load of about 90 tons. The designer of the station is M. Urbain Casan, and the work is being carried out under the supervision of M. Peltier, Bridge and Highway Engineer and Director of Technical Services to the Marseilles Chamber of Commerce, in collaboration with M. Bordas, Technical Service Engineer, states a Reuters trade service message.

Buenos Ayres Western Railway Notes.—About 55 per cent. of the £600,000 four per cent. three-year bearer notes (1934) have been lodged for conversion under the terms of the offer, of which details appeared in THE RAILWAY GAZETTE of December 10, 1937. The notes matured on January 1, and holders were offered the right to apply for an extension as to 75 per cent. of the nominal value of each note for a further three years. Noteholders accepting the offer were to receive the balance in cash together with a cash payment of £1 17s. 6d. for each £100 nominal of notes for discount.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 52nd Week			Totals to Date		
	1937	1936	Inc. or Dec.	1937	1936	Inc. or Dec.
	£	£	£	£	£	£
L.M.S.R. (6,867 mls.)						
Passenger-train traffic...	413,000	397,000	+ 16,000	26,881,000	25,832,000	+1,049,000
Merchandise, &c. ...	362,000	402,000	− 40,000	25,760,000	24,916,000	+ 844,000
Coal and coke ...	229,000	240,000	− 11,000	13,569,000	12,690,000	+ 879,000
Goods-train traffic ...	591,000	642,000	− 51,000	39,329,000	37,606,000	+1,723,000
Total receipts	1,004,000	1,039,000	− 35,000	66,210,000	63,438,000	+2,772,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	295,000	287,000	+ 8,000	17,665,000	16,902,000	+ 763,000
Merchandise, &c. ...	275,000	291,000	− 16,000	17,774,000	17,146,000	+ 628,000
Coal and coke ...	262,000	250,000	+ 12,000	13,113,000	12,218,000	+ 895,000
Goods-train traffic ...	537,000	541,000	− 4,000	30,887,000	29,364,000	+1,523,000
Total receipts	832,000	828,000	+ 4,000	48,552,000	46,266,000	+2,286,000
G.W.R. (3,739½ mls.)						
Passenger-train traffic...	180,000	179,000	+ 1,000	11,309,000	11,013,000	+ 296,000
Merchandise, &c. ...	147,000	170,000	− 23,000	10,460,000	10,023,000	+ 437,000
Coal and coke ...	91,000	110,000	− 19,000	5,882,000	5,298,000	+ 584,000
Goods-train traffic ...	238,000	280,000	− 42,000	16,342,000	15,321,000	+1,021,000
Total receipts	418,000	459,000	− 41,000	27,651,000	26,334,000	+1,317,000
S.R. (2,147 mls.)						
Passenger-train traffic...	264,000	268,000	− 4,000	16,789,000	16,024,000	+ 765,000
Merchandise, &c. ...	51,500	54,500	− 3,000	3,252,500	3,279,500	− 27,000
Coal and coke ...	37,500	37,500	—	1,607,500	1,614,500	− 7,000
Goods-train traffic ...	89,000	92,000	− 3,000	4,860,000	4,894,000	− 34,000
Total receipts	353,000	360,000	− 7,000	21,649,000	20,918,000	+ 731,000
Liverpool Overhead ... (6½ mls.)	1,243	1,234	+ 9	67,795	62,049	+ 5,746
Mersey (4⅜ mls.) ...	4,375	4,524	− 149	220,189	215,674	+ 4,515
*London Passenger Transport Board ...	541,600	547,200	− 5,600	15,163,700	15,153,400	+ 10,300
IRELAND						
†Belfast & C.D. pass. (80 mls.)	1,573	1,383	+ 190	129,760	130,452	− 692
,, ,, goods	540	395	+ 145	25,181	28,010	− 2,829
,, ,, total	2,113	1,778	+ 335	154,941	158,462	− 3,521
Great Northern, pass. (543 mls.)	10,250	9,550	+ 700	574,150	558,300	+ 15,850
,, ,, goods	7,800	7,500	+ 300	489,250	504,400	− 15,150
,, ,, total	18,050	17,050	+ 1,000	1,063,400	1,062,700	+ 700
Great Southern pass. (2,076 mls.)	33,055	34,158	− 1,103	1,897,951	1,878,442	+ 19,512
,, ,, goods	34,524	41,410	− 6,886	2,265,880	2,314,053	− 48,173
,, ,, total	67,579	75,568	− 7,989	4,163,834	4,192,495	− 28,661

Boxing Day 1937 * 27th week (before pooling) † 53rd week

British and Irish Railway Stocks and Shares

Stocks	Highest 1937	Lowest 1937	Prices Jan. 5, 1938	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	67⅝	55¾	64¾	+1½
5% Con. Prefce. ...	127	108	117½	—
5% Red.Pref.(1950)	113	109	110½	—
4% Deb.	113⅝	102½	109	—
4½% Deb.... ...	118	106	109½	—
4½% Deb.	124½	112	117½	+1
5% Deb.	136½	122¾	127½	—
2½% Deb.... ...	76	64	68½	—
5% Rt. Charge ...	133 7/16	118	126½	+1
5% Cons. Guar. ...	133¾	116½	126½	+½
L.M.S.R.				
Ord.	36⅛	25⅜	30	+½
4% Prefce. (1923)	82½	65¾	70	—
4% Prefce. ...	92½	77¾	82	—
5% Red.Pref.(1955)	107¾	102	103½	−½
4% Deb.	108	99¼	104	—
5% Red.Deb.(1952)	117½	111	113½	—
4% Guar. ...	104	95⅞	101½	+½
L.N.E.R.				
5% Pref. Ord. ...	12½	6¾	8½	+¼
Def. Ord.	6¼	3⅜	4⅜	+⅛
4% First Prefce.	79½	63	67½	—
4% Second Prefce.	31½	21	27	+1
5% Red.Pref.(1955)	101¼	89¾	96½	—
4% First Guar. ...	103	91⅞	96	+½
4% Second Guar.	97⅝	85½	90	+½
3% Deb.	84⅛	74	78½	—
4% Deb.	107¼	98½	103	—
5% Red.Deb.(1947)	113½	106½	110½	—
4½% Sinking Fund Red. Deb.	110 5/16	105½	107	—
SOUTHERN				
Pref. Ord.... ...	98⅝	83½	87	—
Def. Ord.	27⅞	16¾	20¼	+1
5% Pref.	126 16/16	105 13/16	114½	—
5% Red.Pref.(1964)	118	110¼	113½	—
5% Guar. Prefce.	133¾	116¾	126	+1
5% Red.Guar.Pref. (1957)	118½	111½	115	—
4% Deb.	112	101¼	106½	—
5% Deb.	135¾	123½	125½	—
4% Red. Deb. 1962–67	113	105	105½	—
BELFAST & C.D.				
Ord.	5	4	4½	—
FORTH BRIDGE				
4% Deb.	106	99½	100½	—
4% Guar. ...	105¾	99	100½	—
G. NORTHERN (IRELAND)				
Ord.	11	5	5½	−1
G. SOUTHERN (IRELAND)				
Ord.	50	21½	27	—
Prefce.	61	34	35	—
Guar.	94¾	69½	67	−3½
Deb.	95	82⅛	81¾	−½
L.P.T.B.				
4½% "A" ...	123¾	110½	117½	—
5% "A" ...	135	121½	127½	—
4½% "T.F.A." ...	108¾	104	106	—
5% "B" ...	125	114½	120½	—
"C"	99¾	75	80	—
MERSEY				
Ord.	42⅝	22	21½	−2
4% Perp. Deb. ...	103	96¾	97	—
3% Perp. Deb. ...	77⅝	74½	75½	—
3% Perp. Prefce.	68¾	61¼	66½	—

CONTRACTS AND TENDERS

Finchley-Edgware Line Improvements

In connection with the scheme of improvements and extensions adopted by the Standing Joint Committee of London Transport and the main-line railways in regard to suburban railways in the London Area, an important contract has just been placed for the widening of the L.N.E.R. line between Finchley (Church End) and Edgware. The work is to be carried out by Fletcher & Co., of Mansfield, and the cost, which is in the region of £25,000, is a part of the £40,000,000 programme approved in 1935. The widening of this particular section of line is a necessary preliminary to its electrification for tube trains from the Northern Line tube. This is being extended from Highgate to join the L.N.E.R. line at East Finchley, and tube trains will run between the West End and City and Edgware. At Edgware a "joint station" to serve both the existing Mordern–Edgware tube trains and also the new services from Highgate over the L.N.E.R. line will be built. It is expected that the widening will be completed this year.

The L.N.E.R. has recently placed orders for 410,000 yards of sacking, 427,000 sleepers, and 2,165,000 gallons of creosote oil.

The Societé d'Electricité et de Mecanique of Gand has received an order from the Belgian National Railways for the power units for 12 double and six single diesel railcars, each unit comprising one Carels-Ganz diesel engine of 380 h.p. at 1,330 r.p.m., Vulcan-Sinclair fluid coupling, and S.L.M. gearbox. (*See also November 26, p. 949.*)

The Hydraulic Coupling & Engineering Co. Ltd. has received an initial order for 25 size 26 fluid couplings of the rigid traction type for the above Belgian railcars.

The Hydraulic Coupling & Engineering Co. Ltd. has also received an order from the Drewry Car Co. Ltd. for seven size 16·25 traction couplings to replace torque converters on New Zealand Government Railways' railcars having Leyland engines of 133 h.p. at 1,800 r.p.m., as this is considered a case where operating conditions favour the combination of fluid coupling and gearbox.

The Hydraulic Coupling & Engineering Co. Ltd. has also received from Andrew Barclay & Co. Ltd. an order for a further size 26 traction coupling similar to others already being constructed for diesel locomotives for the Air Ministry, the engines being rated at 150 h.p. at 1,000 r.p.m. and having Wilson epicyclic gearboxes.

The Metropolitan-Vickers Electrical Export Co. Ltd. has received an order for 17 7½-b.h.p. electric motors for the Central Argentine Railway.

The Metropolitan-Cammell Carriage & Wagon Co. Ltd. has received an order from the Rhodesia Railways for 16 bogie tank wagons of 4,500 galls. capacity.

Superheaters for South African Locomotives

The Superheater Co. Ltd. has received orders for the supply of MeLeSco patent multiple valve regulator superheater headers for the whole of the 65 Class "15F," 116 Class "23," and 95 Class "19D" locomotives now being built by the North British Locomotive Co. Ltd., Henschel & Sohn A.-G., Berliner Maschinenbau A.-G., Skoda Locomotive Works, F. Krupp A.-G., and Borsig Lokomotiv Werke G.m.b.H., for the South African Railways & Harbours Board. This type of header is also being supplied for the 15 "No. 2" class and 10 "No. 2A" class boilers being supplied to this administration by the North British Locomotive Co. Ltd.

Locomotives for Egypt

The Skoda Locomotive Works has received an order from the Egyptian State Railways Administration for four 4 ft. 8½ in.-gauge 2-4-2 type tank locomotives. The total value of the order is £13,552, or £3,383 each locomotive. The lowest British tender was £4,097, states Reuters.

The directors of the Great Western Railway Company have authorised the placing of the following contracts :—

Ransomes & Rapier Limited ; Supply of three 6-ton and three 1-ton petrol-electric mobile cranes.

A. Jackaman & Son Limited ; Construction of a reinforced concrete quay wall at Weymouth.

Ernest C. Jordan & Son ; Construction of carriage-lifting and paint shops at Caerphilly.

Leightons (Contractors) Limited ; Reconstruction and widening of Tycoch Bridge, near Kidwelly station.

West's Rotinoff Piling & Construction Co. Ltd. ; Reconstruction of harbour road bridge and the construction of a retaining wall near Barry station.

George Palmer ; Widening of Gors Bridge near Pembrey and Burry Port station.

H. Smith ; Earthworks for new sidings between Craig Fawr and Cwm Colliery South signal boxes, near Cwm station.

Wharton Crane & Hoist Co. Ltd. ; Supply and erection of two 1-ton transporter cranes at Ponsandane goods shed.

Frigidaire Limited ; Supply and installation of two sets of electrical refrigerating plant in new kitchen cars.

For Swindon Works.

Mercury Truck & Tractor Co. Ltd. ; Supply of seven Mercury tractors.

Burton, Griffiths & Co. Ltd. ; Supply of a four-spindle automatic screwing machine for P.1 Shop.

At the Company's Docks.

East Ferry Road Engineering Co. Ltd. ; Provision of one fixed coal hoist for No. 25 Jetty, No. 2 Dock, Barry.

Penarth Pontoon & Slipway & Ship Repairing Co. Ltd. ; Overhaul of the dredger *Peeress* and ss. *St. Patrick*.

Newport & South Wales Tube Co. Ltd. has received an order from the Great Western of Brazil Railway for approx. 5,800 solid-drawn black steel boiler tubes.

Petrol Shunting Locomotives for New Zealand

The Drewry Car Co. Ltd. has received an order from the New Zealand Government Railways, through the High Commissioner for New Zealand, for seven 3 ft. 6 in.-gauge petrol-driven 0-6-0 type shunting locomotives, each to weigh in working order about 15 tons and to develop approx. 93/120-h.p. The 10-litre Leyland engines for these units will be fitted in New Zealand. The mechanical parts of these locomotives will be in accordance with the usual Drewry standards and will include hydraulic couplings, Wilson-Drewry gearboxes, bevel reverse units, and jack shaft final drive.

The Drewry Car Co. Ltd. has also received an order from the New Zealand Government Railways for two 0-4-0 type 3 ft. 6 in.-gauge shunting locomotives with Parsons 75· h.p. petrol engines and to weigh in working order approx. 9 tons. These locomotives are a repeat order on that for six already supplied by this firm to the same administration.

The G.W.R. announces the following works to be undertaken :—

Bridge Reconstruction.—The following bridges are to be reconstructed :—

Bridge carrying the Hereford and Newport line over public road near Little Mill Junction.

Bridge carrying the Berks and Hants line over River Kennet, near Kintbury.

By arrangement with the Carmarthen County Council, Gors Bridge, over the Burry Port, and Gwendraeth Valley line at Burry Port is to be widened to thirty feet between parapets, and the superstructure raised.

Rolling Stock.—Six rail milk-tank trucks are to be constructed for United Dairies (Wholesale) Limited, in connection with their milk traffic from South Wales. Ten further coaches are to be converted for use as camp coaches.

Telephone Communication.—The telephone facilities between Oxford and Worcester exchanges and between the places connected to them are to be rearranged and extended, as the existing arrangements are inadequate for present-day requirements.

Ring Springs Limited has recently supplied the Metropolitan-Cammell Carriage & Wagon Co. Ltd. with ring spring draftgear for the equipment of the 150 wagons constructed for the Rhodesia Railways. A further order for Ring Spring draftgear has also been delivered to Beyer, Peacock & Co. Ltd. for the six locomotives under construction for the Rhodesia Railways.

Whitelegg & Rogers Limited has recently received orders for 42 Ajax grease lubricators for application to axleboxes of "YK" class locomotives, Madras & Southern Mahratta Railway ; and 20 engine sets of Ajax grease lubricating equipment for new locomotives under construction by the Vulcan Foundry Limited, for the Buenos Ayres Great Southern Railway.

OFFICIAL NOTICES

Great Southern Railways

SENIOR DRAUGHTSMAN.

APPLICATIONS are invited for the appointment of Senior Draughtsman in the Office of the Chief Engineer, Dublin, at a commencing salary of £250/£270 per annum depending on qualifications.

Applicants should have had experience in general civil engineering work, preferably in a Railway Engineer's Office.

Applications, in envelopes endorsed "Senior Draughtsman," stating age, qualifications and experience, and accompanied by copies of not more than three recent testimonials, must reach the undersigned not later than 5.0 p.m. on Wednesday, the 26th January, 1938.

H. S. COE,
Secretary.

Kingsbridge Station,
Dublin.
January, 1938.

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite Tenders for :—

1,561 CWTS. BRIGHT DRAWN STEEL BARS FOR AUTOMATIC MACHINES.

Specification and Form of Tender can be obtained at the Company's Offices, 123, Victoria Street, Westminster, London, S.W.1.

Fee ONE GUINEA, *which will not be returned.*

Tenders must be submitted not later than 2 o'clock p.m. on TUESDAY, 25TH JANUARY, 1938.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
G. W. V. DE RHE PHILIPE,
Secretary.

THE Proprietors of British Patents No. 376,189, entitled "Improvements in and relating to Oil Cataract-Control Gear," No. 382,486, entitled "Improvements in Smoke Consuming Devices for Furnaces," and No. 390,280, entitled "Improvements in and relating to Steam Auxiliary Blower and Over-Grate Air Control Gear for Smoke-Consuming Devices, more particularly for use on Locomotives," desire to arrange for the commercial working of these patents by sale outright or by licences granted on participating and reasonable terms. Particulars obtainable from TECHNICAL RECORDS LIMITED, 59-60, Lincoln's Inn Fields, London, W.C.2.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to :—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

RAILWAY AND OTHER REPORTS

Assam Railways and Trading Company.—The following dividends have been declared for the half-year to December 31, 1937 : Pre-preference shares, at the rate of 8 per cent. per annum ; new six per cent. preference shares at the rate of 6 per cent. per annum. The dividends were payable on January 4.

Vera Cruz (Mexico) Railways.—The accounts for year ended June 30, 1937, show profit of £5,547 (against £7,779 last year) mainly proceeding from investments and interest in England. £30,279 is brought forward, making £35,826, which the directors have decided to carry forward pending settlement of negotiations with the Vera Cruz Terminal Company, as to the amount to be paid under judgment of October 15, 1935. Nothing is provided in the accounts to meet this possible liability.

Northern Ireland Road Transport Board.—The board announces the payment of interest on the "B" stock. The payment will be at the full rate prescribed by the Road & Railway Transport Act, 1935. It was recently announced in the Northern Ireland Parliament by the Minister for Home Affairs, Sir Dawson Bates, that the income of the board for the past year would not be sufficient to meet the interest on the stock, and a Bill was passed to enable the board to pay interest out of capital on the stock for a period of five years.

Midland Railway Company of Western Australia.—Gross traffic receipts (in Australian currency) for the year ended June 30, 1937, were £155,207, against £161,371 in 1936, a decrease of £6,164 in comparison with the previous year. Working expenses were only very slightly less, £74,494 against £74,641, so that net receipts were £6,017 lower. The working expenses were 48 per cent. of the gross receipts, as against 46·25 per cent. in the preceding period. After transferring £3,000 to tax reserve and £35,000 to depreciation and renewals account, net profit was £35,959, against £37,535. Interest on first debenture stock takes £5,560, and 5 per cent. is again paid on the second mortgage debenture stock, requiring £29,618 ; the balance forward is slightly higher at £30,267, against £29,486. No ordinary dividend has been paid since 1930. During the first four months of the current year traffic receipts amount to £54,675, against £54,054. In addition to the expenditure on ordinary maintenance, £53,037 was expended principally on rails, sleepers, reballasting, and rolling stock, and this has been charged to depreciation and renewals account.

East Yorkshire Motor Services Limited.—This company, controlled jointly by the L.N.E.R. and Tilling & British Automobile Traction Limited, reports a total revenue for the year ended September 30, 1937, of £291,640, in comparison with £274,744 for 1936. After deducting all expenses and providing for depreciation, there is a balance of £37,789 (against £43,709) which, with £8,868 brought forward, makes a total of £46,656, against £52,868. The appropriation to General Reserve this year is £10,000 (against £20,000), and the dividend is again 10 per cent., requiring £30,000, leaving £8,868 to be carried forward. The issued capital was increased by the allotment of 60,000 shares of £1 each.

Scottish Motor Traction Co. Ltd.—This company, in which the London Midland & Scottish and London & North Eastern Railway Companies have each a large shareholding, earned a net profit for the year ended October 31, 1937, of £149,984, after providing for all charges, including depreciation. Adding dividends from subsidiary companies and deducting interest, income tax, directors fees, etc., the net profit was £198,858, against £184,451 for 1935-36. A dividend of 6½ per cent. on the cumulative preference shares accounts for £49,156, while £30,000 are allocated to Contingency Reserve and £40,000 to General Reserve. The dividend on the ordinary shares is maintained at 10 per cent., and £76,081 is carried forward. Although improved industrial conditions favoured the company, these were offset to a certain extent by a strike of drivers and conductors in March last. A number of competitive businesses has been acquired, the principal of which is "Coast Line," under which title the bus department of the Musselburgh & District Electric Light & Traction Co. Ltd. was operated.

Crompton Parkinson Limited.—Net profit on working for the year ended September 30, 1937, was £403,864 against £353,858 in the previous year ; £79,232 (against £63,430) is brought forward, making £483,096, compared with £417,288 in 1935-36. Of this £290,884 is transferred to General Reserve (as against £224,963) and after providing for the dividends on the 8 per cent. first preference and 6 per cent. second preference, £73,008 is available for a distribution to the ordinary shares, including the interim dividend, at the rate of 12½ per cent. for the year, leaving £70,546 to be carried forward.

Midland Bank Limited.—The directors report that full provision having been made for all bad and doubtful debts, the net profits for the year 1937 amounted to £2,508,009 which, with £547,084 brought forward, makes £3,055,093, out of which the following appropriations amounting to £1,554,881 have been made : To interim dividend, paid July 15, 1937, for the half-year ended June 30, 1937, at the rate of 16 per cent. per annum, less income tax, £854,881 ; to reduction of bank premises account, £400,000 ; to reserve for future contingencies, £300,000 ; leaving £1,500,212 from which the directors recommend a dividend, payable February 1 next, for the half-year ended December 31, 1937, at the rate of 16 per rate. per annum, less income tax, £909,168, and a balance to be carried forward of £591,044. For 1936 the net profit was £2,467,894, the dividend was 16 per cent., and the allocations were : To reduction of bank premises, £350,000 ; and to reserve for contingencies, £300,000.

XUM

Railway Share Market

Towards the middle of the week there was a firmer trend in most sections of the Stock Exchange and the amount of business was reported to be better than for some time past. Sentiment was stimulated by the view that the United States may decide on a large rearmament programme, in which case it is likely metal and commodity prices would show a good recovery. Home railway stocks reflected the better tendency.

The aggregate traffic increase of £7,106,000 for the past year proves to be well in excess of market expectations current in the early part of 1937, and although expenditure may have increased a good deal in the second half of the year, there is a general tendency in the market to continue to take an encouraging view of next month's dividend announcements. The traffic receipts for the past week show a decrease of £79,000, but this was a smaller reduction than had been anticipated. It is difficult to compare the past week's figures with those of the last week of 1936, which did not include Boxing Day and New Year's Day.

Although there is a good deal of uncertainty in the market whether the dividend will be raised to 1½ per cent. or 2 per cent., L.M.S.R. ordinary was in good demand and has risen to 30. On the other hand, the 4 per cent preference at 82 and the 4 per cent. 1923 preference at 70 were out of favour, despite the generous yields offered. Great Western ordinary was active up to 65, aided by hopes of a possible increase in dividend to 4 per cent. L.N.E.R. second preference was firm at 26½, while the first preference was 67½. Southern deferred was better at around 20 and transferred up to 20¼ at one time, it being realised that on the basis of a 1 per cent. dividend, which is possible according to some market estimates, a favourable yield would be offered at the current price. Guaranteed and debenture stocks were firm and inclined to make higher prices in sympathy with the rise in British Government securities. Elsewhere, London Transport "C" was out of favour at 79½.

Argentine railway ordinary and preference stocks were reactionary earlier in the week and moved to lower prices, but no heavy selling was reported. Subsequently there was a steadier tendency and the lower prices were inclined to bring in a moderate amount of buying, but this was not sufficient to influence prices. Debenture stocks were dull and lower on balance, although the yields offered appear quite attractive as interest requirements should again be covered by a satisfactory margin in the case of B.A. Gt. Southern, B.A. Western and Central Argentine debentures. American railway stocks improved with the general trend of Wall Street; and Canadian Pacific ordinary and preference were fractionally better.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1937–38	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1936	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1937	Prices: Lowest 1937	Prices: Jan. 5, 1938	Yield% (See Note)
				£	£		£	£	£					
South & Central America	Antofagasta (Chili) & Boliva	834	2.1.38	24,270	— 8,100	1	600	2,370	— 1,770	Ord. Stk.	29	10¼	12½	Nil
	Argentine North Eastern	753	1.1.38	8,666	+ 1,213	27	258,782	247,588	+ 11,194	,,	19¼	6	5½	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	93½	60	80	5
	Bolivar	174	Nov., 1937	2,600	— 2,400	48	55,650	68,600	— 12,950	6 p.c. Deb.	9½	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	17	9	11½	4 16
	Buenos Ayres & Pacific	2,806	1.1.38	88,834	— 11,352	27	2,140,449	2,120,824	+ 19,625	Ord. Stk.	17⅛	5½	6½	Nil
	Buenos Ayres Central	190	18.12.37	$94,300	— $64,900	25	$3,234,000	$3,558,400	— $324,400	Mt. Deb.	41½	18	22½	Nil
	Buenos Ayres Gt. Southern	5,084	1.1.38	156,390	— 6,885	27	3,405,211	3,177,934	+ 227,277	Ord. Stk.	33¾	13½	16½	Nil
	Buenos Ayres Western	1,930	1.1.38	45,285	— 14,454	27	1,227,172	1,167,138	+ 60,034	,,	3 3/4	1 1/4	1 1/2	Nil
	Central Argentine	3,700	1.1.38	130,635	— 21,247	27	3,427,187	3,783,334	— 358,147	,,	3 1/4	10¾	12½	Nil
	Do.	—	—	—	—	—	—	—	—	Did.	20½	4½	6	Nil
	Cent. Uruguay of M. Video	980	25.12.37	21,183	+ 2,877	26	431,449	423,011	+ 2,438	Ord. Stk.	67/32	2	2¼	Nil
	Cordoba Central	1,218	1.1.38	24,130	— 7,820	27	821,430	871,950	— 50,520	Ord. Inc.	6¼	1½	2	Nil
	Costa Rica	188	Oct., 1937	22,580	+ 3,354	18	101,026	71,989	+ 29,037	Stk.	38	27	28½	7
	Dorada	70	Nov., 1937	15,800	+ 1,000	48	170,100	156,500	+ 13,600	1 Mt. Db.	107	106	107½	5 9/16
	Entre Rios	810	1.1.38	16,272	+ 2,916	27	368,291	346,456	+ 21,835	Ord. Stk.	19 7/16	6	6½	Nil
	Great Western of Brazil	1,092	1.1.38	11,300	+ 3,300	1	500	1,600	— 1,100	Ord. Sh.	5/4	1/8	5/8	Nil
	International of Cl. Amer.	794	Nov., 1937	$50,126	+ $82,245	48	$5,379,250	$4,650,651	+ $728,599	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	2/-	1/-	1/2	Nil
	La Guaira & Caracas	22¾	Dec., 1937	4,830	— 1,335	52	61,575	56,700	+ 4,875	Stk.	8½	6	8½	Nil
	Leopoldina	1,918	1.1.38	22,413	— 5,108	1	2,009	2,789	— 780	Ord. Stk.	9¼	3	3¾	Nil
	Mexican	483	31.12.37	$38,100	— $8,500	26	$7,634,100	$7,048,700	+ $585,400	,,	1½	¼	½	Nil
	Midland of Uruguay	319	Nov., 1937	9,439	+ 421	22	42,148	41,315	+ 832	,,	1/8	1/2	1/2	Nil
	Nitrate	384	31.12.37	9,351	+ 2,446	52	154,113	119,211	+ 34,902	Ord. Sh.	3 1/16	2	2 3/16	Nil
	Paraguay Central	274	1.1.38	$3,029,000	+ $473,000	27	$87,360,000	$63,775,000	+ $17,585,000	Pr. Li. Stk.	84	79¼	77½	7¾
	Peruvian Corporation	1,059	Dec., 1937	76,928	— 4,604	26	514,036	449,785	+ 13,251	Pref.	14¾	4½	5	Nil
	Salvador	100	25.12.37	£26,750	— £6,750	26	£361,125	£361,358	+ £767	Pr. Li. Db.	23½	21½	22½	Nil
	San Paulo	153½	25.12.37	26,354	— 4,248	52	1,678,134	1,536,816	+ 141,318	Ord. Stk.	98½	56	64	7 15/16
	Taltal	160	Nov., 1937	3,465	— 925	22	16,350	16,810	— 460	Ord. Sh.	17 6	11/16	3/4	13 5/16
	United of Havana	1,353	1.1.38	18,147	+ 2,958	27	442,721	426,914	+ 15,807	Ord. Stk.	5 5/8	3 1/32	2	Nil
	Uruguay Northern	73	Nov., 1937	921	+ 362	22	4,320	5,055	— 735	Deb. Stk.	10	2	3½	Nil
Canada	Canadian National	23,803	21.12.37	731,538	— 19,397	51	38,635,463	36,100,573	+ 2,534,890	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	—	4 p.c.	Perb. Dbs.	77	62½	65½	6 3
	Grand Trunk	—	—	—	—	—	—	—	—	½ p.c. Gar.	10 7/8	9 1/2	100	4
	Canadian Pacific	17,385	31.12.37	771,800	+ 17,200	52	29,017,000	27,712,600	+ 1,304,400	Ord. Stk.	18	7¼	7½	Nil
India†	Assam Bengal	1,329	10.12.37	35,715	— 2,423	36	942,780	905,828	+ 36,951	Ord. Stk.	86	73½	78½	3 15/16
	Barsi Light	202	10.12.37	2,947	+ 315	36	90,150	80,798	+ 9,352	Ord. Sh.	66½	46	54	9¼
	Bengal & North Western	2,197	10.12.37	73,176	— 7,949	11	514,401	526,934	— 12,533	Ord. Stk.	317	301	305	5 8
	Bengal Dooars & Extension	161	2.12.37	3,430	— 232	38	108,419	97,567	+ 10,852	,,	100	84	86½	7
	Bengal-Nagpur	3,268	2.12.37	193,125	+ 33,175	38	4,932,124	4,364,286	+ 567,838	,,	101	89	90½	4 16
	Bombay, Baroda & Cl. India	3,072	31.12.37	278,325	— 49,725	39	6,532,125	6,292,200	+ 239,925	,,	113	110½	111½	5 8
	Madras & Southern Mahratta	3,229	10.12.37	140,400	— 23,345	36	3,761,084	3,722,788	+ 38,296	,,	110	105	107½	7 15/16
	Rohilkund & Kumaon	572	10.12.37	13,851	— 1,744	11	86,608	90,294	— 3,686	,,	314	302	307	5 11/16
	South Indian	2,531¾	30.11.37	103,783	+ 4,456	34	2,778,934	2,671,149	+ 107,785	,,	103½	99½	100½	4 3/4
Various	Beira-Umtali	204	Oct., 1937	95,714	+ 27,209	5	95,714	68,505	+ 27,209	—	—	—	—	—
	Egyptian Delta	620	10.12.37	7,900	— 311	36	183,881	174,138	+ 9,743	Prf. Sh.	31/-	3/4	1 1/4	Nil
	Great Southern of Spain	—	—	—	—	—	—	—	—	Inc. Deb.	3½	1/2	3½	Nil
	Kenya & Uganda	1,625	Nov., 1937	210,808	+ 19,924	48	2,514,047	2,321,904	+ 192,143	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48 1/3	43 1/2	45 1/2	8 5/4
	Midland of W. Australia	277	Nov., 1937	14,455	+ 1,259	22	63,130	67,251	+ 1,879	Inc. Deb.	98	93½	93½	4 1/4
	Nigerian	1,900	2.11.37	78,813	— 6,651	34	1,620,943	1,250,877	+ 370,066	—	—	—	—	—
	Rhodesia	2,451	Oct., 1937	467,363	+ 112,132	5	467,363	355,231	+ 112,132	—	—	—	—	—
	South Africa	13,263	11.12.37	709,828	+ 17,479	37	23,715,614	22,208,472	+ 1,407,132	—	—	—	—	—
	Victoria	4,774	June, 1937	793,223	+ 83,530	52	10,135,291	9,689,925	+ 445,366	—	—	—	—	—
	Zafra & Huelva	112	Sept., 1937	15,307	+ 8,641	39	117,046	65,948	+ 51,098	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value.

Electric Railway Traction

RAILWAY ELECTRIFICATION IN 1937

RELATIVELY large electrification works were a characteristic of the year 1937. In addition to the lengths of line turned over to electric operation during the past twelve months several conversion schemes of great magnitude were in hand, including the Manchester—Sheffield line of the L.N.E.R., the Tours—Bordeaux section of the P.O.-Midi Railway, the Nuremberg—Halle division of the Reichsbahn, the central Holland lines of the Netherlands Railways, and the Paoli—Harrisburg section of the Pennsylvania Railroad. This country took a leading part in electrification progress, thanks to the inauguration of electric traction on the Portsmouth and Aldershot lines of the Southern Railway, covering a route mileage of 95 and a track mileage of 242; actually, a small part of this scheme, from Hampton Court junction to Weybridge and Virginia Water, had an electric service from the beginning of December, 1936. The Mersey Railway increased its converting plant by two 750 kW. rectifier sets, and the L.N.E.R. took delivery of a large number of new coaches for the Tyneside electrified lines. The L.P.T.B. proceeded with its big programme of new stock, and placed with B.T.-H. a £1,000,000 order for the electrical equipment of more than 800 coaches. By the end of the year the Wirral electrification of the L.M.S.R. was almost complete.

Exceeding even the Portsmouth scheme, the conversion of the Paris—Le Mans main line of the French State Railways covered the electrification of 131 miles of route, equivalent to 497 miles of track, and formed the greatest conversion of the year. The estimated cost, including 58 locomotives and 20 stainless-steel trains, but excluding widening works in the neighbourhood of Paris, was 403,000,000 fr. It is interesting to note that the yearly train mileage since conversion is about 4,760,000, most of which is locomotive-hauled, whereas the Portsmouth line total is approximately 4,200,000, and is all worked by multiple-unit trains. Single-phase electrification in Sweden followed its normal course, and the most important openings of the year were the lines from Upsala to Gävle, and from Laxå to Kil and Charlottenberg, on the Norwegian frontier, 126 miles. The only Norwegian extension was the 8-mile suburban line from Oslo to Olbotn forming the first portion of the through route from the Norwegian capital to Gothenburg and Malmö. After the opening to 3,000-volt d.c. electric traction of the long southern main line from Salerno to Reggio Calabria in April (which gave continuous electric traction from Bologna to Reggio, 697 miles), electrification work slackened off somewhat on the Italian State Railways, but several schemes of first importance are under way, including the Milan—Bologna, Bologna—Ancona, and Rome—Leghorn routes. Electrification of the North Milan Railway was extended from Milan to Como in April; the standard train sets were used at first, but some new 27-ton stainless-steel motor-coaches have been delivered since. Only the short section from Sonceboz to Court was electrified on the Swiss Federal Railways during 1937 (a landslide prevented the programmed conversion on to Moutier), but the new Etzel hydro-electric power station was opened, and some triple-car high-speed electric trains were introduced. Both the Pilatus and Vitznau—Rigi rack railways were changed from steam to electric traction, and in each case the three-phase supply is converted in rectifiers to a line current of 1,500 volts d.c. Just within the confines of Europe, the Chussovskaia—Goroblagodatskaia division of the Soviet railways was finally turned over to electric traction on the standard 3,000-volt d.c. system; the whole Kisel—Chussovskaia—Goroblagodatskaia—Sverdlovsk main line, 240 miles long, is now electrified. A short extension to the Moscow Metro was made during the year, and the Moscow electrified suburban system was extended far down the Yaroslavl main line to Alexandrov, although all the main-line trains are not yet hauled electrically. Four months after the opening of the Pruszkow—Warsaw—Otwock section of the Polish State Railways in December, 1936, the Pruszkow—Zyrardow extension along the south-western main line was opened in March last, and the final section of the Warsaw suburban conversion scheme—from Vilna junction to Minsk—in December, 1937, the conversion work being carried out by the English Electric Co. Ltd. and the Metropolitan-Vickers Electrical Co. Ltd. Further electrification schemes in Poland are expected shortly.

Another Metro-Vick activity was the conversion of the Central Railway of Brazil's main line, the first, or suburban, portion of which from Rio de Janeiro to Madureira was opened to multiple-unit electric traction in the summer. The same company was associated also with the rapid development of electrification in South Africa, as it received orders for a total of 42 of the standard 1,200 h.p. electric locomotives, making a total of 159 Metro-Vick locomotives at work on, or on order for, the South African system. The Reef electrification, most of which was completed during the year, comprises the conversion of 131 route miles (350 track miles), and this, together with the Glencoe—Volksrust division, the most northerly section of the Natal main line, also converted during the year, is supplied through substations with B.T.-H. mercury-arc rectifiers. Once again the Pennsylvania Railroad was responsible for the only railway electrification in the United States, apart from subway lines, and pushed ahead with amazing rapidity on the conversion of the Paoli—Harrisburg main line and branches, involving the equipping of 315 route (773 track) miles on the 11-kV. 25-cycle single-phase system; most of the main line passenger working is scheduled for the change-over to electric traction early this year.

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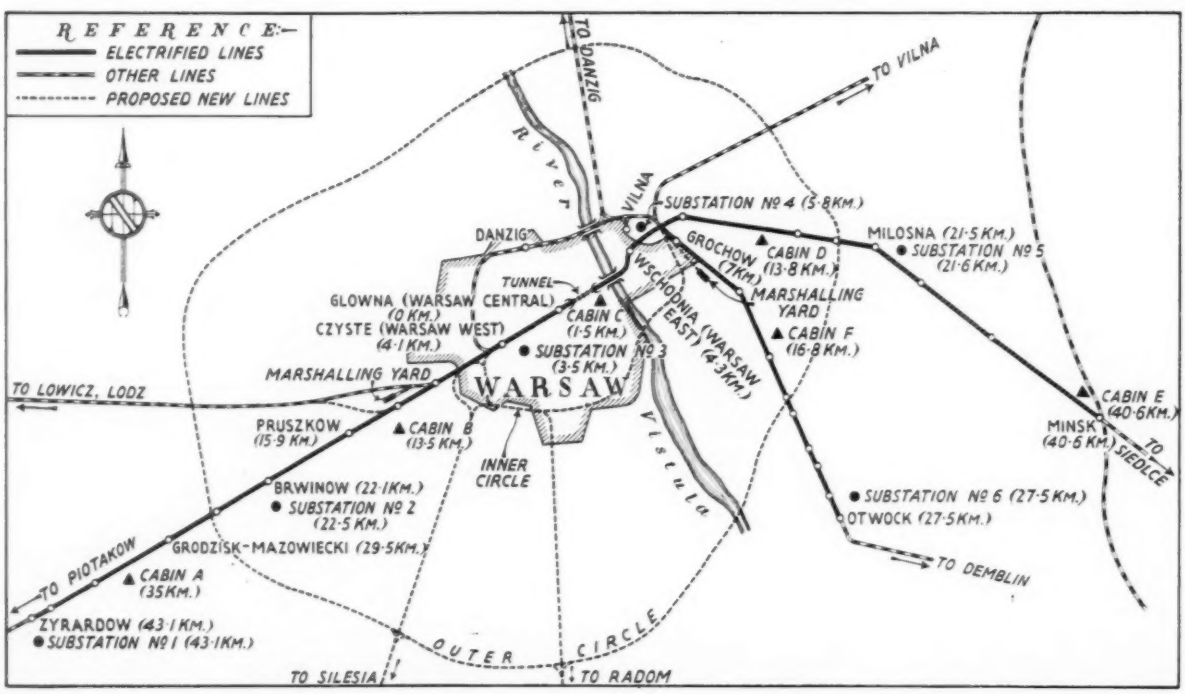
RAILWAY ELECTRIFICATION IN POLAND

Completion of £2,000,000 scheme

AT the restoration of Poland's independence in 1918 the country's railways were in a precarious condition. They had been seriously damaged during the war and organisation in three separate systems was very unsatisfactory. Considerable repair and re-organisation were therefore necessary and a comprehensive policy of unification and modernisation was adopted. Under this policy one of the most important improvements undertaken was the construction of a new route through the city of Warsaw, and its electrification as the first stage of the Warsaw suburban electrification. This work is now complete, electrical service from Pruszkow, on the south-western line, through Warsaw, and out to Otwock, on the south-eastern line, a distance of about 29 miles, having been inaugurated by the Polish Vice-Premier on December 15, 1936, and the remainder—from Pruszkow to Zyrardow in March, 1937, and from the Vilna junction to Minsk—in December, 1937.

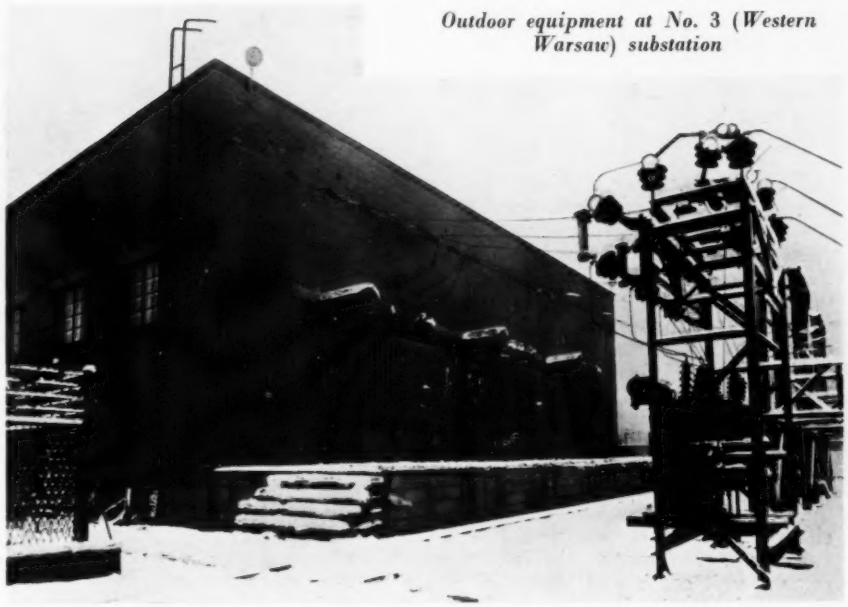
Previous to the recent developments, Warsaw was served by four terminal stations, two on each side of the Vistula, and these were connected solely by a long loop line, which was the only route for through traffic across the river. Each terminal served its suburban area, and the Central station, in addition, accommodated the main line expresses. Thus the Warsaw traffic was characterised by excessive terminal operation and no through suburban traffic. The solution of these difficulties was obviously to construct a line through the heart of the city to connect the Central and Eastern stations, thus enabling the passenger service to be dealt with at through stations, with the consequent avoidance of terminal troubles. To carry out this scheme it was necessary to construct a tunnel underneath part of the city west of the Vistula, and owing to the difficulty of providing adequate ventilation it was clear that electric traction would have a great advantage over steam. To electrify the short new line (4·6 miles)

Map showing Polish electrification proposals as mooted some years ago



Map of the electrified suburban lines of Warsaw, Polish State Railways

only, would obviously have been disadvantageous on financial and operating considerations, but investigation showed that suburban and local traffic density was sufficient to justify general electrification to a radius of about 25 miles. A special commission reported in 1922 that appreciable economies could be effected by electrification; technical opinion later confirmed this view, and a detailed scheme was drawn up. The direct connecting line between the Central and Eastern stations involved the lowering of the level of the former and the raising of the latter, and it was in use for steam trains before the first stage of electrification was finished. The very comprehensive proposals for the electrification of main lines made some years ago were detailed in the issue of this Supplement for January 12, 1934, and the small map on the opposite page shows all the principal routes concerned.



Outdoor equipment at No. 3 (Western Warsaw) substation

In 1933, with the help of the English Electric Co. Ltd. and the Metropolitan-Vickers Electrical Co. Ltd., it was found possible to finance the first part of the scheme. This covered the electrification of the new through line and three important lines radiating from the city to Zyrardow (25·5 miles); to Minsk (22·5 miles); and to Otwock (14 miles), and this work was begun under a contract signed in August, 1933. The route mileage electrified is 65 and the track mileage about 155. The work has been carried on by a committee of the contractors in close co-operation with the Polish Ministry of Communications. The amount of the contract was approximately £2,000,000, of which roughly £1,000,000 has been expended in Poland on civil and electrical work.

The electrical operation is at 3,000 volts d.c. The selection of this high voltage, which has the advantage of low distribution losses with a minimum number of substations, was influenced by consideration of the length of lines to be served and the nature of the traffic, consisting of both suburban multiple-unit trains and main-line locomotives. Advantage has been taken of the latest developments in rectifier equipment and high-voltage d.c. equipment for multiple-unit trains and locomotives. The electrical equipment covered by the contract included six rectifier substations, the overhead line equipment, six 2,200 h.p. electric locomotives, and the complete electrical equipment of 76 three-coach trains and four shunting locomotives. The switchgear and a considerable amount of accessory equipment have been supplied by Polish subcontractors.

Substations and Track Sectioning Cabins

Energy is delivered to the contact line at a tension of 3,300 volts d.c. on the bus-bars, converted in rectifiers from 35,000-volt, three-phase 50-cycle current drawn from a large supply network fed from Pruszkow and Warsaw power stations.

A careful analysis revealed that the power requirements could be met most advantageously by the provision of 13 mercury arc rectifier units installed in six substations located at suitable points along the line. Substations *1* and *5* each contain two 2,000 kW. rectifier units; substations *2*, *4* and *6* each contain two 2,500 kW. units; and substation *3* has three 2,500 kW. units. Track-sectioning cabins, containing high-speed d.c. circuit breakers, have been provided between adjacent substations, for the purpose of isolating sections of the line in the event of trouble or repair work on any one or more sections.

On the e.h.t. side of the substations, continuity of supply is ensured by the provision throughout of two or more incoming feeders, enabling each substation to draw its energy from Pruszkow or Warsaw power stations, or from both. Normally the power stations operate in parallel and represent a combined capacity of approximately 143,000 kVA., of which the maximum rated load of the rectifier substations is some 35,000 kVA. Substations *1*, *3* and *6* were equipped by the English Electric Co. Ltd. and substations *2*, *4* and *5* by the Metropolitan-Vickers Electrical Co. Ltd.; the a.c. switchgear was supplied by Polish subcontractors, and the buildings for all substations were provided by the Polish State Railways.

At each substation on the incoming 35-kV. supply feeders are taken to outdoor steel structures where they are connected to isolating switches, lightning arresters, potential and current transformers, and led to the oil circuit-breakers and bus-bars. From the e.h.t. bus-bars leads are taken through isolating switches and circuit-breakers to the outdoor rectifier transformers. The oil circuit-breakers shown have a three-phase rupturing capacity of over 500,000 kVA. The housing of the outdoor controls of these breakers encloses a small electric heater, so that reliable operation of the mechanism is obtained during winter when very low temperatures occur. Protection of the incoming feeders is afforded by impedance/time (distance) relays, and earth leakage indication only is provided, since the system is designed to operate with the neutrals earthed through arc suppression coils. Tripping of the rectifier oil circuit-breakers is effected by overload relays with inverse time limit characteristics, as well as by relays which operate instantaneously under short circuit conditions.

The rectifier transformers, which are of the outdoor self-cooled type, are three-phase, star-connected on the primary side, and six-phase fork-connected on the secondary. The transformers are also equipped with a tertiary six-phase star-connected winding for baking-out the rectifiers at low voltage. The terminals of this

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winding are adjacent to the corresponding terminals of the secondary winding, so that the minimum amount of labour is involved when changing over the anode leads from rectifier to bake-out service during erection or overhaul periods.

Rectifiers

From the secondary terminals of the main transformers, bare copper leads are taken through leading-in insulators to the six-anode steel-tank rectifiers situated inside the substation buildings. The incoming supply to the rectifier is six-phase 50-cycle, 2,650-volt, and the d.c. delivery on the continuous rating is 3,300-volt 607-amp. The rectifiers are capable of sustaining overloads of 25 per cent. for 15 min. and 200 per cent. momentarily. The rectifiers are fitted with control grids in the arc path, so that the controlling features of the energised grid, such as d.c. voltage variation or grid switching, can be utilised; at the moment the rectifiers are being used in the normal manner with plain characteristics.

Cooling of the rectifiers is effected by passing water through the jackets, cathode, and anode plates and circulating it by means of a 1 h.p. pump running at 1,400 r.p.m. through air-blast recoolers. The main recooler unit consists of groups of finned radiator tubes assembled between headers in a rectangular housing; air is forced over the tubes by a centrifugal blower driven by a 4 h.p. motor running at 700 r.p.m. and thermostatically controlled. The recooling unit is at rectifier potential, and is mounted on insulators.

The rectifiers are all provided with vacuum pumping sets, comprising high and low vacuum pumps, the former being of the mercury vapour type and the latter of the self-cooled rotary type. This rotary pump provides a low backing pressure for the mercury vapour pumps; it is of the vane impeller type and runs submerged in oil. Its driving motor is rated at 0·45 h.p. at 1,400 r.p.m. and is supplied from the 220-volt auxiliary circuit. The pump sets are switched in or out, according to the vacuum obtaining in the rectifier, by means of a relay operating in conjunction with a Pirani vacuum gauge. A separate air-blast recooling equipment is provided for the high vacuum pump which may be running when the rectifier

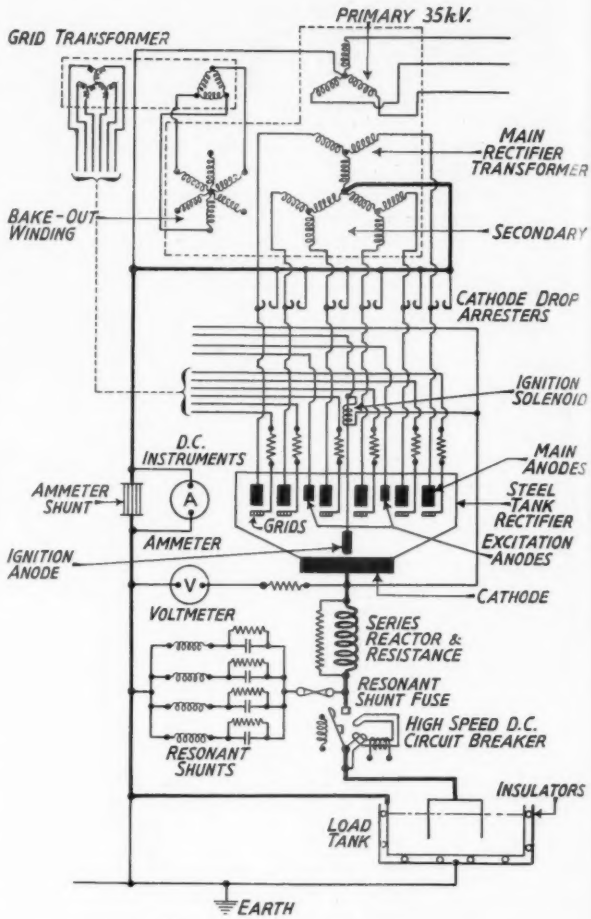
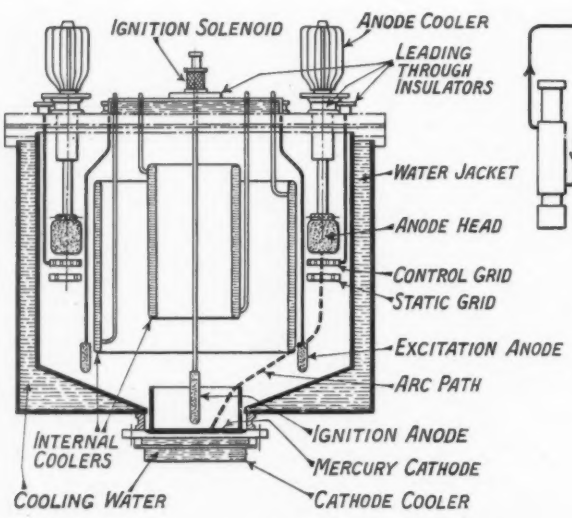


Diagram of main connections of rectifier substations on the Warsaw suburban electrification of the Polish State Railways



Diagrammatic section through English Electric steel tank mercury arc rectifier as supplied to Poland

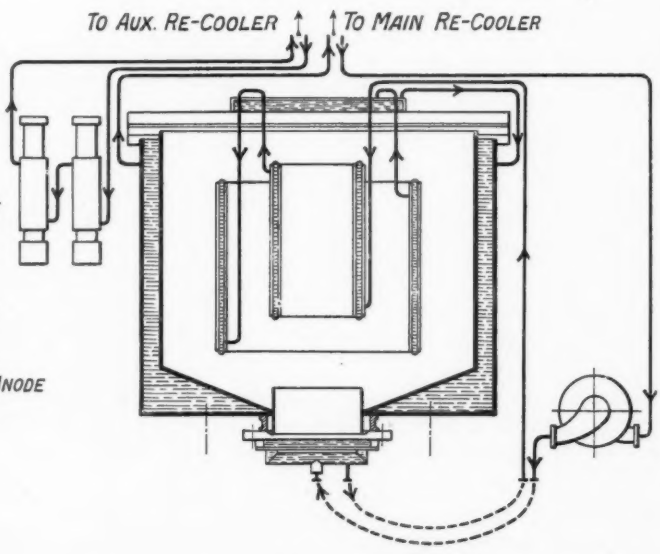
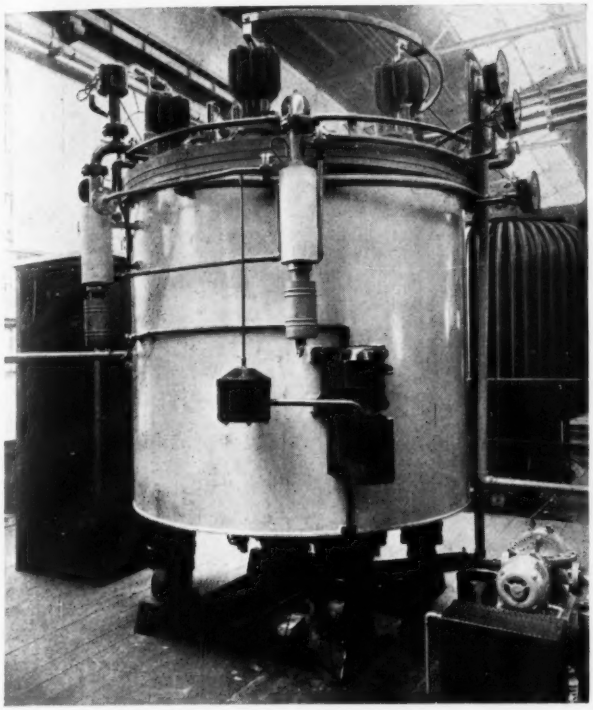
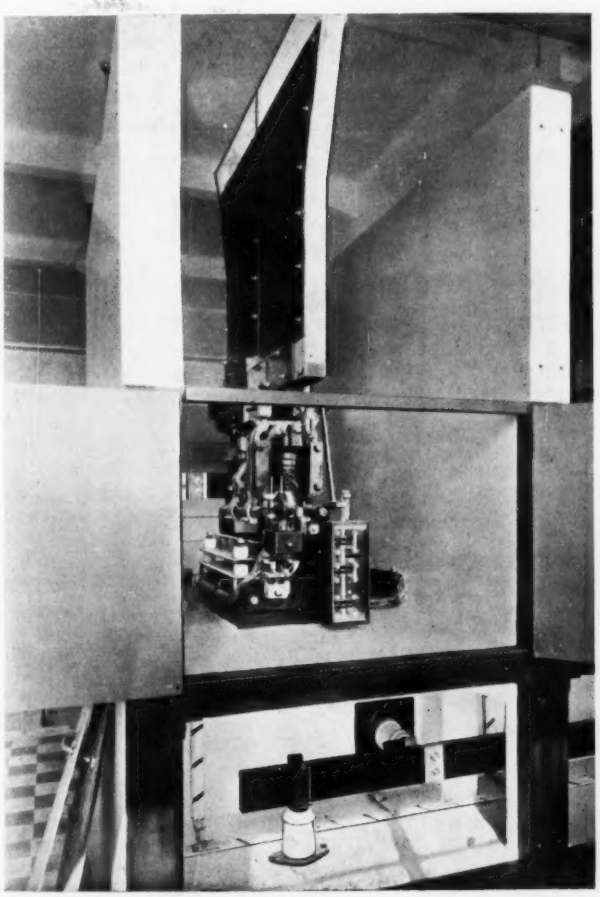


Diagram of water-cooling circuit for English Electric steel tank mercury arc rectifier



2,000 kW. steel tank English Electric mercury arc rectifier



Metro-Vick high-speed circuit-breaker in its cubicle

is out of service, thus obviating the necessity of running the larger recooler continuously for this purpose. This recooler is of the horizontal type and is arranged so that the air is blown vertically.

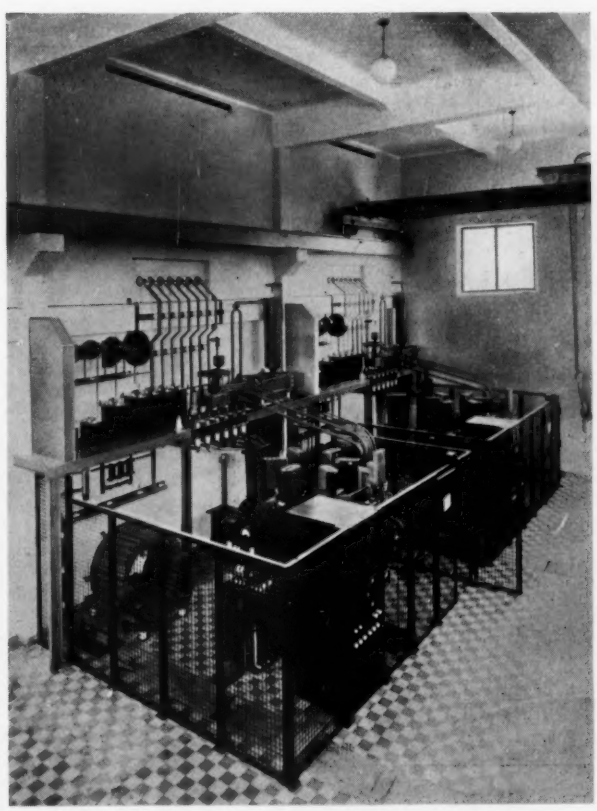
The guaranteed overall efficiencies of the rectifier units, including transformer and auxiliary losses, are as follows:

Load	5/4	4/4	3/4	2/4	1/4
Efficiency, per cent.	96·07	96·6	96·82	96·72	95·57

The actual efficiency figures, measured on test by the method of summation of losses, appreciably exceed these guaranteed figures.

On the d.c. side the rectifiers are protected by high-speed breakers of Metropolitan-Vickers manufacture. These breakers are designed for reverse current tripping and are installed in the lead between the cathode and d.c. bus-bars. The breakers are located in stonework cells on a gallery together with the d.c. isolating switches, and controlled from panels located below. The control panels and d.c. isolating switches were manufactured in Poland. The outgoing d.c. feeders are also equipped with similar high-speed breakers. These are arranged for auto-reclosing and overload tripping in the forward sense, *i.e.*, when excessive current flows outwards from the sub-stations. A bus-tie and feeder testing equipment is provided and so arranged that it can be connected in circuit in the place of any one of the feeder breakers, when necessary.

Smoothing equipment is provided with each rectifier; it comprises a series reactor in the cathode lead and four resonant circuits connected between the positive and negative poles of the rectifier unit. The four resonant circuits each consist of a condenser and small reactor in series tuned to resonance at 300, 600, 900 and 1,200 cycles respectively, and protected by high rupturing capacity fuses. The short reactors are made in two sections



Interior of substation on Polish State Railways

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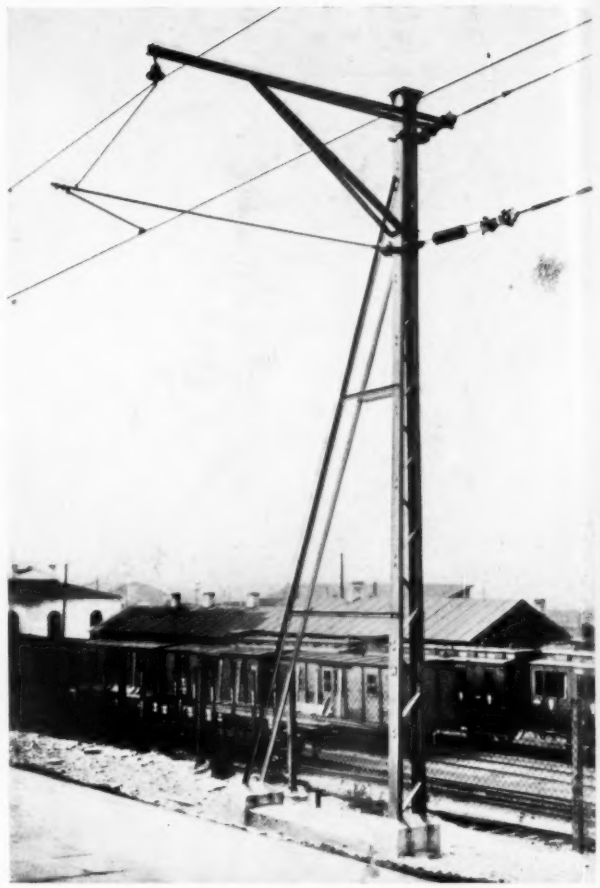
which permits of adjustment of the inductance for tuning purposes by varying the distance between the sections. With the smoothing equipment in operation, the r.m.s. value of the voltage ripple is less than 1½ per cent. of the normal d.c. voltage, with a sine wave of supply voltage at the primary terminals. Supply for the various substation auxiliaries, heating and lighting, is obtained from auxiliary transformers connected through outdoor fuses to the 35 kV. network, and from a substation battery.

Control of the substations is effected manually in the case of substation *3*, but remote and local control is provided for all other substations. Substation *4* is controlled from substation *3* by remote control equipment of the code-selector type, operating over two telephone pairs; the remaining substations are controlled over multi-core cables from the nearest railway station. The remote control facilities include control and indication of all substation breakers and rectifiers, indication of lockout conditions, meter readings and telephonic communications. In addition, the substations are provided with all necessary protective apparatus for shutting down equipment in the event of a fault.

In each of the six track-sectioning cabins, the incoming lines from the catenary are connected to a common 3,300-volt bus-bar through high-speed breakers arranged for forward tripping only. The fully automatic reclosing equipment is arranged for operation from the 3,300-volt incoming lines, thereby eliminating the necessity of control batteries and charging gear in the track cabins.

Overhead Equipment

The overhead equipment was supplied by British Insulated Cables Ltd., Prescot, under a sub-contract including the design, supply and erection of all material necessary to convey power from the d.c. bus-bars in the various substations to the pantograph collectors on the trains, together with the bonding of the earth return and structures.



Fixed catenary and single contact wire arrangement

Overhead line construction, showing bracket arm construction and tensioning weights

The main-line overhead equipment consists of two 100 sq. mm. hard-drawn copper grooved contact wires, alternately suspended by flexible droppers from a 19/·083 in. cadmium-copper catenary. The catenary is supported and the contact wires registered in position from a galvanised tee-bar and tie rod cantilever fixed on insulators which are carried on a steel supporting mast. At the end of each tension or drum length the catenary and contacts are brought to a common yoke and tensioned by cast iron balance weights mounted on the mast. The load is transferred by a galvanised steel chain passing over ball-bearing pulleys. There is a mid-point anchoring arrangement at the centre of the tension length and the intermediate cantilever supports swing as a gate with movement of the equipment due to changes of temperature. A uniform tension is thus maintained in the conductors irrespective of the temperature change. The up and down lines are kept mechanically independent. The normal span length is 72 m. (236 ft.) for tangent track, and where necessary on curves the span length is shortened, or pull-offs introduced, to give the correct registration of the contact wire.

For tangent tracks the contact wire is normally staggered 30 cm. (11¾ in.) from the centre of the pantograph in opposite directions at adjacent supports, the wires being central on the pantograph at the mid-point of the span. On curves the registration of the contact wires at each support is carefully regulated to give the best conditions against the possibility of a blow-off in the centre of the

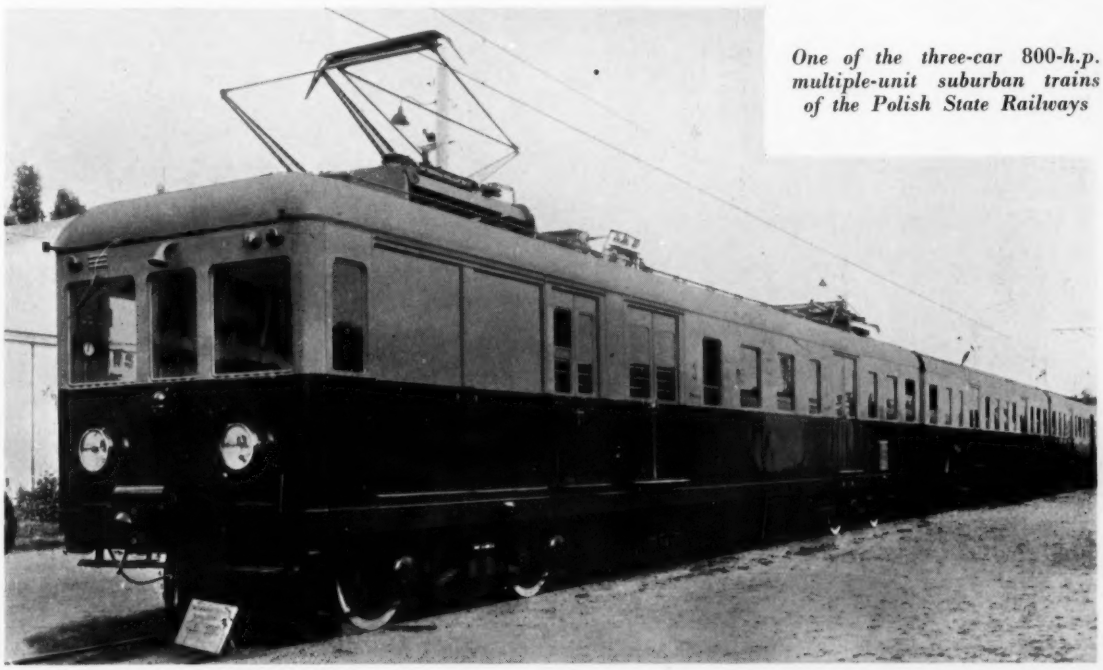
A typical cross-suspension in a station

span. The normal tension length is 1,200 m. (three-quarters of a mile) and before each wire is turned out for anchoring on a mast, the contact wires are kept in parallel running for a short distance to ensure a smooth transition of the pantograph from one tension length to the next. No mechanical splices are used in the contact wire, and as far as possible the line is adjusted to give uniform flexibility. In sidings and junctions it is desirable to keep the equipment as simple as possible, and for this reason a system using a fixed catenary and a single contact wire terminating with steel compression springs has been adopted.

The line passes from Warsaw Central through a tunnel approximately 1,200 m. (0·75 mile) long, then over a viaduct and the Vistula bridge to Warsaw East. The type of equipment adopted for the tunnel, where the clearances are very limited, is a fixed catenary, supporting two alternately suspended contact wires, which are anchored by springs at each end of the tunnel. The catenaries are supported from cross spans and, as far as possible, all insulation is kept away from the direct blast of steam locomotives.

The normal supporting masts consist of two No. 12 channels with riveted strip bracing, but on the Minsk line the masts have welded batten plates. In junctions and for special work, light fabricated bridges have been used and for multiple track work cross span construction has been adopted. All steelwork and a considerable proportion of the overhead copper has been manufactured and supplied in Poland. The work of installing the foundations has also been carried out by Polish subcontractors; the mast foundations normally consist of a concrete block in which a cored hole is left for the reception of the steel masts. The masts are grouted in these holes after erection. In Warsaw East and Warsaw West, where cross span construction is used, foundation bolts are installed with the foundations.

Single disc type insulators have been used for the supports and the insulation between tracks in junction work. Double insulation has been used for all terminating insulators, switch insulators, and section insulators. The fittings have, as far as possible, been made of non-ferrous material, but where ferrous, they have been galvanised. The switches are of a robust knife type mounted on the masts and operated from ground level. They are not designed to break under load, as the normal protection of the overhead line, in case of a fault, is afforded by



One of the three-car 800-h.p. multiple-unit suburban trains of the Polish State Railways

the high-speed breakers in the track-sectioning cabins and substations.

The connection between the substations, track-sectioning cabins and the overhead line is by means of paper-insulated lead-covered armoured cable. A lightning arrester is mounted on the overhead equipment at each feeder position. All rail joints are bonded with a flexible copper bond, electrically welded to the rails. The structures are normally connected by a copper earth wire, and where automatic signalling is used or proposed, connections are taken from the structure to the neutral point of impedance bonds; otherwise frequent cross bonds and bonds to traction return rails are used. At special points, such as the tunnel, the Vistula bridge, and certain overhead bridges, spark gaps have been used to connect between the structures and the rails. Each section of the overhead line, when completed, is pressure tested at 9,000 volts for two hours, *i.e.*, three times normal working voltage, and all feeder cables are pressure tested to British Standard Specification.

Multiple-Unit Trains

The suburban traffic is being served by 76 train sets, each consisting of a motor-coach and two trailers, the latter coaches being articulated together through a common bogie. There is seating accommodation for 80 passengers in the motor-coach, 93 in the non-driving trailer and 99 in the driving trailer; these figures include a number of tip-up seats in the vestibule and luggage compartments. All coaches have lavatory accommodation and there is a luggage compartment adjacent to that containing the control gear in the motor-coach.

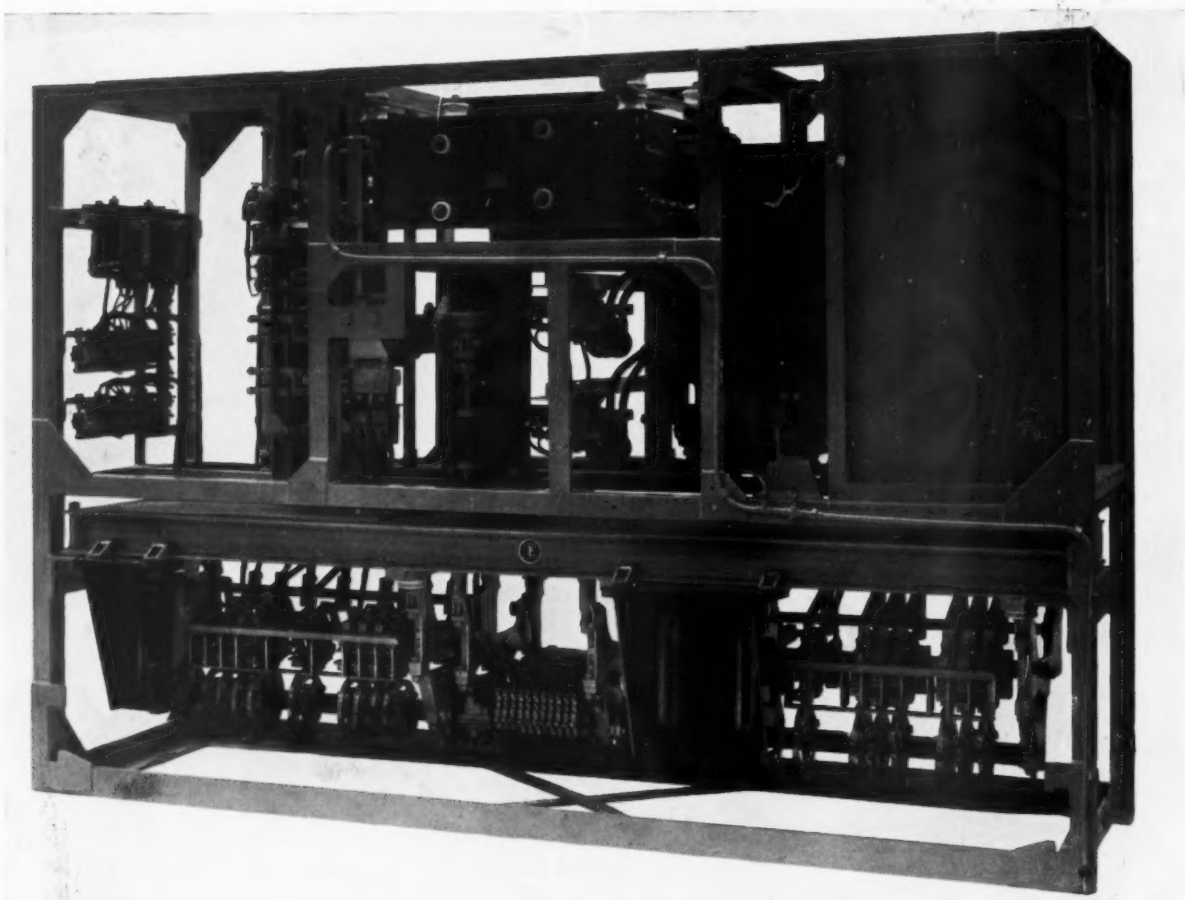
The motive power is derived from four 200 h.p. traction motors all of which are mounted on the axles of the motor-coach. The control equipment is coach-mounted in a special compartment, while the auxiliary machines and main resistances are carried on the underframe. The traction motors are of the coach-ventilated series-wound type with two stages of weak field control. Although insulated for full line voltage they operate two in a permanent series, each at 1,500 volts, and have ratings in accordance with B.S.S. 173 for class B insulation as given in the accompanying table.

TRACTION MOTORS—MULTIPLE-UNIT STOCK

Self-ventilating through coach. Gear ratio 74 : 21.
Field control : 100 per cent. ; 70 per cent. ; 56 per cent. Wheel diameter 1,000 mm. (39·3 in.).

Rating	H.P.	Volts	At full field	
			Tractive effort Kg.	Speed Km.p.h.
Cont.	144	1,500	760	52·3
One-hr.	200	1,500	1,250	44·2

The transmission between motors and wheels is through straight spur gearing, with the gears housed in fabricated steel cases. The armature rotates in roller bearings, and the frame is suspended in the usual manner by sleeve bearings on the axle, and a resilient block supporting the nose. An earth brush is also provided between the motor



English Electric auxiliary and high-tension cabinet used in the multiple-unit trains of the Polish State Railways

frame and the wheel axle. Though the motors are of the usual self-ventilating type, the air is drawn through louvres in the sides of the coach body connecting with the motor frames by ducts and flexible bellows.

Current is drawn from the overhead contact wires by a pantograph of the single-pan type identical with those of the locomotives. Two pantographs are mounted on each motor coach and interconnection or isolation is effected by means of pole-operated isolating links. A small hand-operated pump is used for raising the pantograph in the event of the air reservoirs being exhausted. The main circuit continues through a main power fuse of the cartridge type enclosed in a fire-proof box, and through a choke coil which in conjunction with a condenser-type lightning arrester provides the necessary surge and lightning protection.

The control gear is mounted on two removable frames in separate compartments, the doors of which are interlocked to prevent opening when the apparatus is alive. To facilitate removal, all interconnecting cables are taken to terminal boards, while the coach body is provided with suitable doors through which the frames may be withdrawn. One frame carries the main high tension control

Standard-gauge 2,200-h.p. electric locomotive, Polish State Railways

gear, the other houses control apparatus for the auxiliary and control circuits.

The system of control is of the English Electric motor-operated camshaft controller type suitable for multiple-unit operation. The general scheme of control provides that apart from transition, no current is broken in any part of the apparatus except in the line breakers, of which there are four arranged to open in two stages, the first set inserting a resistance, which has the effect of limiting the current, the second set finally rupturing that current. The line breakers and reverser are electro-pneumatically operated. The series-parallel grouping of the motors, cutting out of the resistance steps, and the stages of field control are carried out by the camshaft controller, which ensures positive mechanical sequence and thus eliminates a number of electrical interlocks that would otherwise be necessary. The main starting resistance is of the continuous strip light-weight unbreakable type and is mounted on the underframe with double insulation.

The movement of the train is governed by a master controller which is provided with the usual mechanical interlocks and with a dead-man button device. Provision is made for manual or automatic acceleration in the forward direction under the control of a current-limit relay, but in reverse only manual control is available. The control circuit is at 110 volts and this is energised by a 10 kW. motor-generator set mounted beneath the car body. The motor runs directly off the 3,000-volt line and is controlled by a remote-operated contactor of the electro-magnetic type; the generator output is governed by a voltage regulator. For emergency operation of the control circuit, compressor and emergency lighting, a nickel-iron type battery of 73 cells is provided; this normally floats across the low tension side of the motor-generator set, and is protected by the usual cut-out devices. The apparatus controlling the motor-generator set and battery circuits is mounted on a panel which is accessible from the driver's compartment. The remaining auxiliary circuits are also controlled from this panel and comprise the motor-compressor circuits and the lighting and heating of the train.

Braking is of the Westinghouse electro-pneumatic type and air is supplied from a 110-volt motor-driven compressor unit. The motor is started up through one step of resistance which is automatically cut out as the speed rises. The compressor also provides power to operate door closing and opening gear, which is under the control of the driver. Contacts are provided on the master controller to ensure that power cannot be applied to the motors until all the doors have been closed and the brakes released. The normal lighting supply is derived from the motor-generator set at a tension of 110 volts, two circuits being provided through the length of the train, each controlled by a remote-controlled electro-magnetic contactor.

Coach heating is carried out by means of heaters mounted on the coach floor. Each heater is rated at 700 watts, 28 of these being carried on each motor-coach and 32 on each trailer. The heaters are arranged in banks of four in series across the 3,000-volt bus-line. Two circuits are provided though the train lengths, each under the control of an electro-magnetic contactor; one circuit, affording roughly half the total heating, is switch-controlled; the other circuit is arranged for thermostatic control. The control wires and bus lines between coaches are taken to roof-mounted connection boxes which are joined by semi-permanent jumpers. Suitable jumpers, plugs and sockets are supplied at the two ends of the three-coach train to permit of multiple-unit operation, but no provision is made for interconnecting the train units for heating purposes, each three-coach unit being considered self-contained in this respect. In addition to the master-controller and electro-pneumatic brake valve, the driver's cab equipment includes sundry control switches and one or two low tension indicating instruments, together with a speed indicator. A window heater as well as a cab heater is provided in the driver's compartment.

Locomotives

The locomotives are to be used for passenger services and also for hauling freight trains through the tunnel section. They are of 2,200 h.p. rating and each locomotive weighs 78 tons. The construction is of the Bo+Bo type, the body being carried upon a pair of bogies each with two driving axles. The bogies, which have a wheelbase of 9 ft. 3 in. each, are coupled together by an articulated joint which is designed to transmit the draw-bar pull without imposing any strain upon the locomotive body. The joint allows the bogies to swivel freely, and to angle and rise vertically to one another when traversing the curves and grades. The joint has no lateral play, and thus constrains the bogies on curves in such a way as to minimise and equalise the tyre wear.

The body is a single structure 40 ft. long and 9 ft. 6 in. wide, and is divided into five main compartments all connected by a corridor on one side of the locomotive.

XUM

These compartments comprise the driver's cab at either end, one chamber for high-tension gear and resistances, and two auxiliary equipment chambers. The high-tension chamber is in the middle of the locomotive, and access to this chamber can only be obtained through a sliding door which is electrically interlocked.

Each axle is driven by a 550 h.p. series-wound interpole, axle-mounted nose-suspended motor, operating through a resilient gear. The main characteristics of each motor are as given in the accompanying table.

TRACTION MOTORS, LOCOMOTIVES

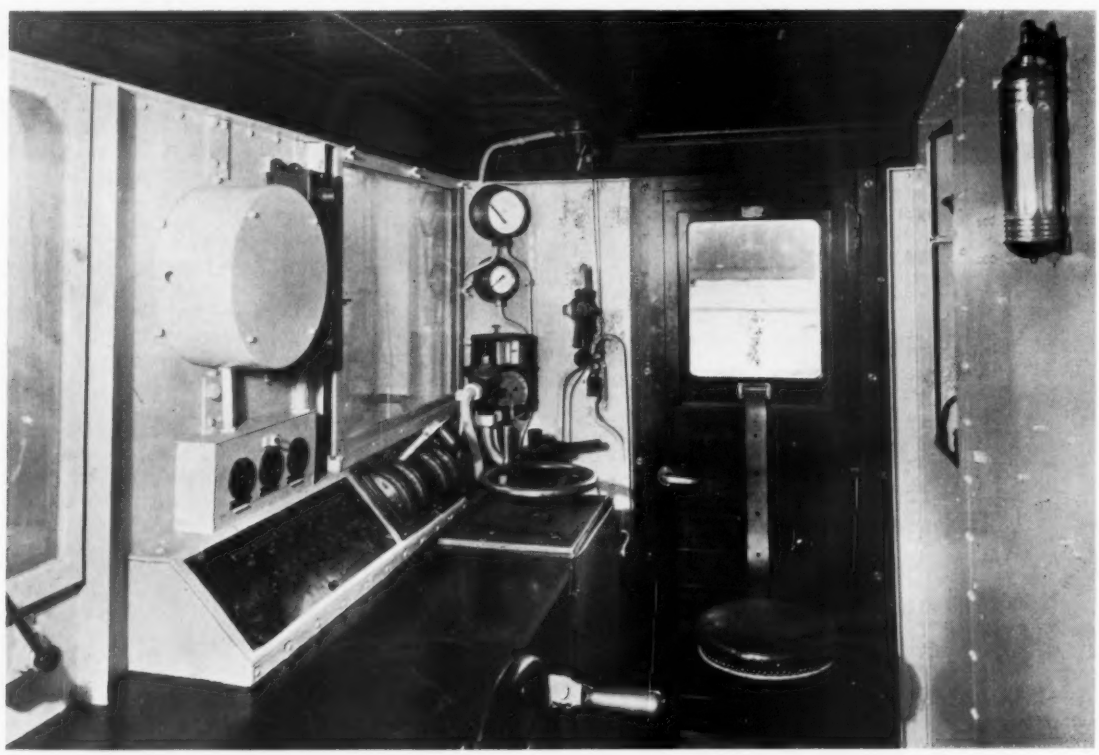
Forced ventilated. Gear ratio 22 : 69.
Field control—4 steps. Wheel dia. 1,220 mm. (48 in.).

Rating	H.P.	Volts	At full field	
			Tractive effort, Kg.	Speed, Km.p.hr.
Cont.	450	1,500	7,200	68
One-hr.	550	1,500	9,500	64

The motors are forced-ventilated by means of blowers, one for each pair of motors, situated immediately above them, and delivering air through flexible ducts into the motor frame, where it divides into two paths, one through the armature and the other through the field system. The circulation is assisted by fans mounted on the armature. The motors are wound for 1,500 volts, insulated for full line voltage of 3,000 volts, and are permanently connected two in series. The control circuit is arranged for two combinations, namely, one circuit of four motors in series, and two circuits of two motors in series.

Situated on the roof are two pantographs, air-operated and spring-controlled, which are of light but strong and rigid construction. Lifting is by an air piston, and is operated so that in raising the pantograph is caused to rise rapidly through the first part of its movement, but slowly through the last stages, so as to obviate bouncing on the wire. The single collecting pan is mounted in a special manner, so that uniform horizontal position is maintained as the pantograph follows variations in the height on the contact wire, irrespective of the position of the point of pressure on the pan. Other items of roof equipment are pantograph isolating switches, fuses, a lightning arrester, and choke coils.

The high-tension compartment houses the contactors and resistances for controlling the main motors, and also the high voltage control for the auxiliary equipment. To ensure safety, the compartment is specially locked, and can only be unlocked by the use of the reverse key of the master controller. Furthermore, even with this key, the high-tension chamber cannot be unlocked until the pantograph has been dropped, removing completely all contact with the 3,000-volt overhead line system. Two machine compartments contain the motor-generator blower set, which consists of a 3,000-volt motor operating a 110-volt generator, which gives energy for the control circuits, lighting and auxiliary services, together with energy for the compressor motor, which supplies compressed air for the brake system and the operation of the electrical contactors. The set also operates the blower which supplies forced ventilation to the main motors. In the corridor is mounted a nickel-cadmium battery which supplies the auxiliary services in an emergency, should the low voltage generator fail.



Driving compartment of double-bogie electric locomotive, Polish State Railways

The motors are controlled by means of contactors which are mounted in the high-tension compartment. These contactors make the various motor combinations and insert the appropriate resistances in the main circuit of the motors under the control of the master controller and overload relays. The control is of the Metropolitan-Vickers

electro-pneumatic unit switch type, in which the contactors are individual switches of the air break type, with magnetic blowout. A very high pressure is maintained between the contacts, which are closed by means of compressed air pistons, actuated through electrically-operated air valves, and opened by very strong springs which prevent any possibility of the contacts freezing when called upon to open very heavy currents. The reverser is a two-position drum type switch operated by a compressed air engine, and reverses the current in the main fields. The electrically-operated air valves which actuate the pistons of the unit switches are controlled through the master controller in the driver's cab. This master controller is of the drum type with two drums, one for reversing and the other for effecting the required combinations of control circuits. The driving drum has 32 control notches, which provide for a sufficient number of resistance steps together with the series-parallel combination and three stages of field weakening.

A Westinghouse automatic air brake system is installed for operating the brakes on the locomotive and the train, and an independent straight air brake is also provided on the locomotive. Separate brake cylinders are fitted to each bogie, and operate a system of levers and balance beams, which cause equal pressure to be applied to the blocks. In addition a hand brake is fitted which operates through a hand wheel and screw conveniently placed in each driving position, and so arranged that power is applied separately from each driver's stand, and also independently to each bogie.

Because of the severe climatic conditions, double windows with air space between are fitted in front of the driver, and a powerful air-operated window wiper is provided; also heaters are fitted in the driver's cab. In connection with the signal system, lever arms are provided on the track which in the danger position will operate a train stopping device, thus cutting out the control and applying the brakes independently of the driver.

MULTIPLE-UNIT TRAINS FOR NEW ZEALAND

3 ft. 6 in. gauge four-motor trains of 660 h.p. for suburban traffic

AS a result of the deviation of the main trunk route in the North Island of New Zealand through Tawa Flats, the previous route from Wellington to Johnsonville has become a suburban line, and has been electrified. Although not the first electrified section of the New Zealand Government Railways, it is the first to be operated by multiple-unit trains, and the six two-car trains required for the initial electric operation have just been completed by the English Electric Co. Ltd. The motors and control equipment were manufactured at the company's works at Bradford, and the trains were built and erected at Preston works.

These trains are to provide a fast and frequent service over the Johnsonville line, which is eight miles long and single track. For about five miles of the distance there is a continuous ascent of 1 in 40, and numerous tunnels limit the contact wire height to 12 ft. 3 in.; over open track the normal contact wire height is 16 ft. The 1,500-volt d.c. in the contact line is fed from a substation supplied by the State hydro-electric network, and the electrification work was carried out simultaneously with that of the Wellington-Paekakariki section of the main line. Consideration was given in the beginning to the possibility of building the mechanical portions of the trains at the Hutt Valley shops of the New Zealand Government Railways, but this was found to be impracticable.

The underframe and body are of all-steel welded construction, the side and roof panelling being of 16 s.w.g. copper-bearing steel. The whole of the inside surface of the panelling, and the body framing, has been sprayed with an adhesive and with wool flock, to minimise the discomfort of noise to passengers when the trains are running. Dovetailed sheet steel flooring is welded to the underframe, the dovetailed section of the sheeting providing a locking device for the Induroleum compound floor laid on top. The interior panelling is carried out in light brown Rexine, the wood mouldings are polished mahogany, and all interior metal fittings are chromium-plated. The aim has been to provide a bright cheerful interior finish attractive to the suburban travelling public.

Pneumatic control of the passenger entrance sliding doors has been included, the equipment having been made by G. D. Peters & Co. Ltd. The opening and closing of these doors is under the control of the guard, who can operate all doors on a train from any passenger entrance, where door control boxes are located. These door control boxes are inoperable without the use of a guard's key; it is not possible, therefore, for the doors to be opened or closed by passengers. A third push button in the door control boxes enables the guard to signal the driver both visually and aurally that he may start. As a further safeguard the power control relay previously mentioned interrupts the control supply until all doors are completely closed. This relay may be short-circuited by a sealed switch in the event of a failure of the door gear making it impossible to start the train.

A motor-coach seats 68 passengers and the trailer has 73 seats; the total tare of a two-car rake is 58 tons and the horse-power on the one-hour rating is 660. The coaches are heated electrically by ten 500-watt heaters fitted along each side. Each heater is wound for 150 volts; the set of ten in series on each coach side is supplied from the line, and each trailer is supplied from the adjacent motor-coach. The coach lighting is supplied at 120 volts from the motor-generator set and a Chloride electrical storage battery. Provision is made for emergency lighting from the battery only, and for this purpose one half the coach lights together with the headlight and tail and marker lights are connected direct to the battery.

Welded plate frame construction has been adopted for the bogies, and the design includes a spring bolster. The 36½-in. rolled steel disc wheels are forced on axles carried in SKF roller bearings. Track-operated automatic train stops are provided, and the trip gear is secured to the axleboxes at both ends of the motor-coach and at the driving end of the trailer. Westinghouse electro-pneumatic air brakes are fitted, and operate through normal clasp-type brake rigging. The master controller is fitted with a plunger-type dead man handle, and emergency brake valves are fitted in the passenger compartments. Hand brake operating pillars stand in the baggage compartment and in passenger compartments opposite the driving cabs, as owing to the restricted area of the cabs these were the only available locations. Tecalemit nipples for grease lubrication of all wearing parts are fitted throughout the coaches.

The electrical equipment provides for electro-pneumatic

control with automatic acceleration of the four traction motors, and multiple-unit operation of trains of up to 12 coaches to meet future requirements. Power is picked up from the overhead contact wire by a double-pan pantograph mounted at one end of the motor-coach roof. Owing to the extremely low contact wire on the parts of the electrified section, it was found necessary to lower the roof under the pantograph but a clear height of 6 ft. 6 in. is obtained in the passenger compartment underneath. The roof-mounted equipment is completed by a choke coil, condenser-type lightning arrester, and a main fuse.

Motors and Control Gear

The two traction motors in each bogie of the motor-coach are connected in permanent series for a contact wire pressure of 1,500 volts d.c. Each motor has a one-hour rating of 165 h.p. at 750 volts and 185 amp. and has one weak field tap. The continuous output per motor is 120 h.p. at 750 volts, 135 amp. The motors can give a normal acceleration of 1·5 m.p.h.p.s. on a 1 in 40 grade, and are suited to a maximum track speed of 60 m.p.h.

The motors are nose-suspended in the two trucks of the motor-coach and drive through spur gearing consisting of a 17-tooth chrome-nickel steel pinion and a 63-tooth resilient gear wheel. The gear wheel has a cast-steel boss and a two-part fish-plated chrome-nickel rim; power is transmitted from rim to boss through two helical springs which cushion the drive and relieve the motor of much of the road shock. Roller bearings are provided for the armature shaft, and sleeve bearings for the axles. The motors are self-ventilated. The cooling air is drawn in through Visco metallic air filters mounted in the coach side; the air passes *via* sheet metal ducts and a flexible leather bellows to the motor-air intake and is discharged through screened outlets at the pinion end of the motor frame.

The control is of the unit switch electro-pneumatic type. The whole of the 1,500-volt control gear is mounted in a specially designed interlocked high-tension compartment under the coach floor. This compartment is an innovation in undercar mounted equipment in that the compartment has been incorporated as part of the underframe structure, and has enabled valuable economies in space and weight to be achieved. The space factor was one of great importance, as the broken underframe construction required to provide steps at the passenger entrances minimised the length of underframe available for mounting the equipment if adequate provision were to be made for easy accessibility for maintenance. This feature has been given considerable attention in the layout of the switch groups and relays.

On the other side of the coach underframe are mounted the rustless unbreakable type main resistances (made by the Rheostatic Co. Ltd.), a 4 kW. motor-generator set, a Westinghouse compressor for the supply of air for switch and brake operation, and the e.p. brake unit. An auxiliary battery of the lead-acid type is also suspended from the underframe. The low tension supply at 120 volts for control gear, door and brake operation, and coach lighting, is provided by the motor-generator set. The motor is wound for line volts and the generator voltage is maintained practically constant by a vibrating-reed type regulator. Emergency supply is available from the 53-cell Chloride battery, which is arranged to float across the generator terminals; normal reverse current protection is provided. The voltage regulator panel is fitted in a steel cabinet in the luggage compartment. The cables were supplied by Siemens Electric Lamps & Supplies Ltd. and the conduits by the Simplex Electric Co. Ltd.

Driving cabs have been provided at both ends of the motor-coach and at one end of the trailer. Owing to the demand for the maximum passenger seating accommodation, the cabs occupy only the space between the coach side and the centre end door, a width of 3 ft. and a depth of 4 ft. from front to back being allowed. The cab equipment includes the master controller, with inching, series, parallel and weak field notches; e.p. brake controller; and low-tension control switches. In addition, a colour-light signal box is mounted ahead of the driver to give a visual indication that the pneumatically-controlled passenger doors are closed for starting. A power control relay is fitted in one cab of the motor-coach to interrupt the control supply until passenger doors are fully closed throughout the train.

A push-button variable-acceleration switch is mounted in a convenient position adjacent to the master controller. If this switch is depressed, a shunt coil on the current-limit relay becomes operative, giving the driver some control over the rate of acceleration. This feature provides the flexibility called for by service requirements of acceleration of approximately 1·5 m.p.h.p.s. on a 1 in 40 grade or on level track, with trains varying from a single motor-coach to a motor-coach with either one or, for a proposed future scheme, two trailers. A comfortable adjustable bucket seat is provided for the driver and considerable attention has been given to the location of all apparatus.

NOTES AND NEWS

Rome Underground Shelved.—The proposal for an electric underground railway in Rome has been abandoned owing, it is understood, to considerations of cost.

Finnish Electrification.—Further steps towards the conversion of certain sections of the Finnish State Railways appear to have been taken, and proposals are on foot to submit to the legislature plans for the conversion of the Helsinki-Viborg and Viborg-St. Andreae-Vuoksenniska-Villmanstrand-Simola lines. Power would come from the Imatra generating station and from the one under construction at Rouhiala.

L.N.E.R. Locomotives.—For the Manchester-Sheffield electrification, the L.N.E.R. is to build in its own works the mechanical portions of 70 mixed traffic Bo-Bo electric locomotives, the electrical equipments for which are to be designed, made, and erected by the Metropolitan-Vickers Electrical Co. Ltd. The estimated weight of the locomotives is 80 tons and the horse-power on the one-hour rating will be about 1,850. These machines will work all classes of traffic except the principal passenger trains, for which a small number of express locomotives are to be built.

Swedish Electrification.—At the inauguration of electric traction on the 71-mile Upsala-Gävle line in December, Herr Axel Granholm, who has since retired from the General Managership of the Swedish State Railways, said that originally the conversion of this particular section was sanctioned mainly to provide employment, for the estimated yield was only 2 per cent. on the capital invested. But by the time conversion was completed higher coal prices and increased traffic indicated that a return of 3½ per cent. might be expected. Herr Granholm expressed the hope that on the northern main line electrification would be carried as far as Boden. Towards the end of 1937 another branch, from Karlsborg to Skövde, 27 miles, was turned over to electric working.